GP30

LOCOMOTIVE CONTROL

EMD

ADDENDA
GP-30 LOCOMOTIVE CONTROL HANDBOOK

Pg. 113 - Fig. 1-7

1. Delete pushbutton symbol above BFA contactors.
2. At LOAD REG, delete solid-line arrow pointing to MIN. FLD. and make dotted-line arrow a solid line pointing to MAX. FLD.
3. On the graph, reposition slope of line to strike vertical axis at 1.5 amperes.

Pg. 125 Fig. 1-12

At RH4 - Complete a horizontal line to the pointer axis and label the line: "TO PLR COIL"

Pg. 127 and 129 - Figs. 1-13 and 1-14

At T1 and T2, change designations X1 and X2 to read H1 and H2 respectively.

Pg. 228 - 4th Paragraph

Change paragraph starting with "TR is picked up..." to read as follows:

"TR is picked up, but for purposes of explanation the situation shown in Fig. 2-14 is hypothetical, and for a split second neither SF nor BFA has dropped out."

Pg. 232 - 2nd Paragraph

Change second sentence to read: "IR shorts out FTR coils and holds BTR picked up against transient low voltage during transition by energizing its NP coil with 300 milliamperes control current."

Pg. 232 - Last Paragraph

Add the following to the last paragraph:

"That is, S13 dropping out completes the circuit to pick up P1 and P3, and A-B interlock of P1 opens to drop S24. Dropout of S24 with closed interlock E-F of P1 picks up P2 and P4. P4 picking up opens

A-B interlock and drops out FTR bucking coil P-N. G-H interlock of P4 closing completes the circuit to SF, which in turn completes the circuit to BFA while C-D interlock of SF opens to drop out ORS."

Pg. 308

At brake control rheostat insert vertical pointer with arrow upward.

Pg. 314

Insert contact bar picked up against BR contacts G1 and G2. (Lower right area of page, above drive coils.)

Pg. 406

In second line of Step 1, change "RH6" to read "RH7".

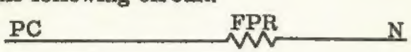
At Back of Book

Plate 8316092

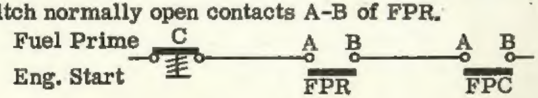
On Engine Start - Stop - Run and Speed Sequence Chart, change the heading of "FP" column to read "FPR".

Plate 8316091

1. At group of circuits entitled "Engine Start Control" add the following circuit:



2. In the circuit containing the engine stop and emergency fuel cutoff switches, make the following changes:
   a. For wire designation PC read POA.
   b. For wire designation N read NA.
3. In the circuit to the fuel pump motor, add between FPC contacts A-B and the fuel prime-engine start switch normally open contacts A-B of FPR.



GP30
LOCOMOTIVE CONTROL HANDBOOK

February, 1962

SERVICE DEPARTMENT

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS CORPORATION

LA GRANGE, ILLINOIS, U.S.A.

Printed in U. S. A.

INTRODUCTION

The purpose of this handbook is to describe the GP30 locomotive control system and provide information relating to operation, adjustment, and trouble shooting of the system.

The major differences between the GP30 power control system and the systems of earlier models lie in:

1. Application and control of main generator battery field excitation.
2. Control of transition from series-parallel to parallel, and control of the steps of motor field shunt.
3. Application and control of dynamic brakes.
4. Control of wheel slip while under power and while in dynamic braking.

The handbook is divided into four sections:

Section 1 covers main generator battery field excitation.

Section 2 covers transition control.

Section 3 covers dynamic brake and wheel slide control.

Section 4 offers information that may be used when checking or trouble shooting the control system.

The text follows in a step-by-step manner the actual sequence of control operation. It is supplemented by graphs and schematic wiring diagrams that appear adjacent to related text.

SECTION 1

GP30 EXCITATION SYSTEM

Figure 1-1 depicts the GP30 excitation and feedback system. It must be understood that the feedback control functions only as an adhesion control system; the governor is the primary engine power output controlling device.

As indicated in Figure 1-1, three phase alternating current for excitation of the D22 generator battery field is taken from the D14 alternator. The primary reason for using D14 current is to provide an excitation range greater than that available in earlier excitation systems. On systems using auxiliary generator power and commutator type load regulators, the excitation range under extreme conditions of temperature is from zero to 45 amperes. Under like conditions of temperature the GP30 excitation system, which uses D14 alternator power and a wirewound rheostat to effect load regulation, has a range of from 1.5 to 60 amperes. The extended range is made possible by the use of 170 volts from the D14 alternator as compared to 74 volts from the auxiliary generator.

D14 alternator current is fed to and rectified by the magnetic amplifier where it is controlled by a power limit relay and a low power load regulator that is under the influence of the engine governor. The rectified and controlled current is then fed to the D22 generator battery field.

The load regulator, is driven by a vane motor identical to that which drives the commutator type. The load regulator is a 100 ohm, 100 watt wirewound rheostat that has the function of controlling the output of the magnetic amplifiers rather than limiting the battery field current directly as does the commutator type load regulator.

A signal proportional to the main generator voltage is taken from the generator voltage transductor GVT. This signal is added to a similar signal, proportional to the main generator current, which is derived from the main generator transductor MGT. The sum of these two signals is then used to limit the output of the magnetic amplifier through a power limit relay PLR. The functions of each of these devices are described in subsequent diagrams and graphs.

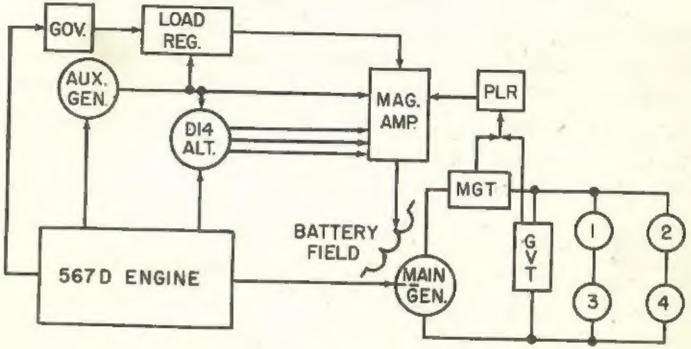
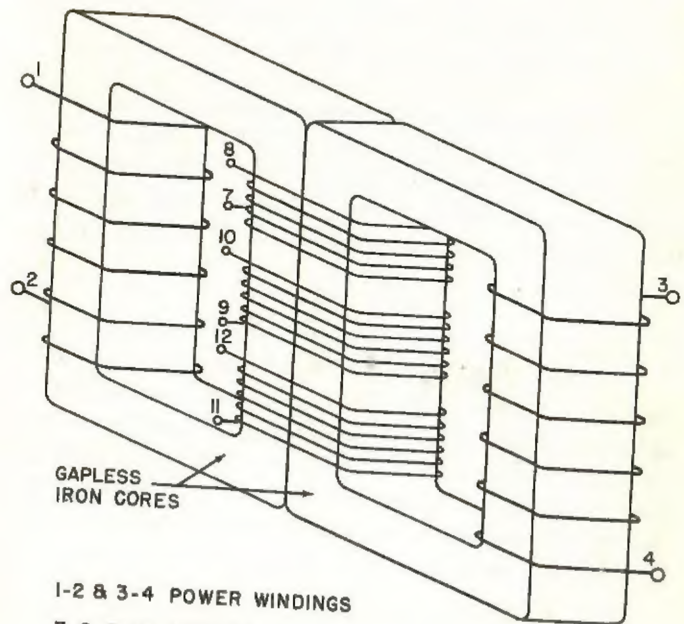


Fig. 1-1 - Excitation System

Figure 1-2 shows one of the three identical reactors which, together with a three phase silicon rectifier, make up the magnetic amplifier. It is the function of the three reactors to control or limit the flow of three phase alternating current from the D14 alternator to the generator battery field. The silicon rectifier, in addition to rectifying this D14 current, insures that current always flows through the reactor load windings in a direction from 1 to 2 and from 3 to 4.

Current flowing through any of the remaining three windings in a direction from 7 to 8, 9 to 10, or 11 to 12 increases the flow of current in the 1-2 and 3-4 load windings. Conversely, any flow of current in these windings from 8 to 7, 10 to 9, or 12 to 11 decreases the flow of current in the load windings.



1-2 & 3-4 POWER WINDINGS

7-8 BIAS WINDING

9-10 & 11-12 DRIVE OR CONTROL WINDINGS

Fig. 1-2 - Battery Field Excitation Reactor

Two types of transductor reactors used on the GP30 locomotive are shown in Figure 1-3.

Two reactors of the type shown in Figure 1-3(A) make up the current transductor MGT. The flow of an alternating current in the AC coils of the current transductor reactors, 1-4, is proportional to the flow of main generator current in the bus passing within their cores.

Two reactors of the type shown in Figure 1-3(B) are used to make up the voltage transductor GVT. The flow of an alternating current in the AC coils of the voltage transductor reactors, 5-6, is proportional to the flow of direct current in coils 1-4. Thus if the current in the 1-4 coils is proportional to the main generator voltage, the flow of AC current in the 5-6 coils is proportional to the main generator voltage.

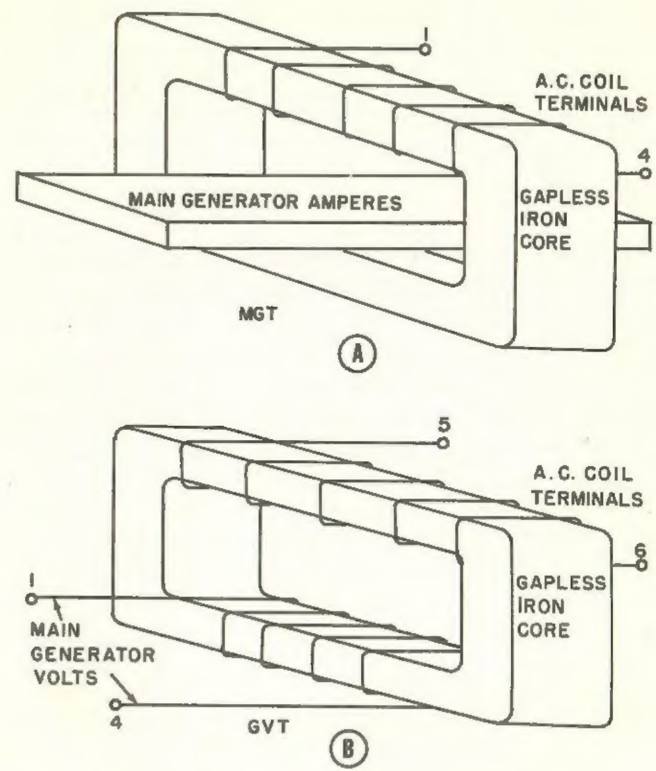


Fig. 1-3 - Current and Voltage Transductor Reactors

Figure 1-4 shows the results of using rectified D14 current for battery field excitation without the benefit of a controlling device. As can be seen from the graph, the current received from the D14 alternator would be greater than the capacity of the battery field. Also, since there is no control over the level of excitation, engine load control and train handling would be difficult.

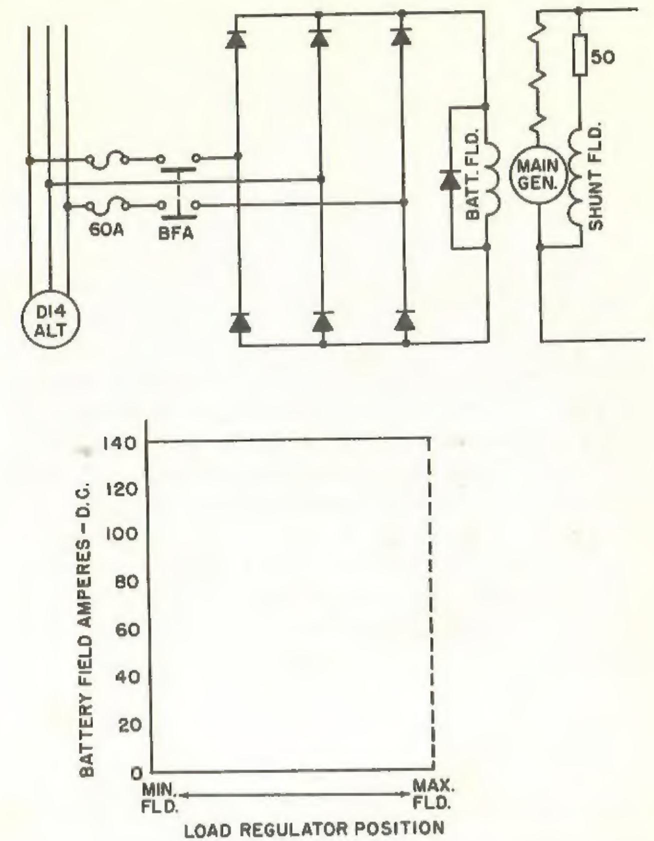


Fig. 1-4 - D14 Current Used To Excite Battery Field Without Reactors

Figure 1-5 shows the drop in battery field current caused by the addition of the load windings of three magnetic reactors, FM1, FM2, and FM3 to the circuit shown in Figure 1-4. The addition of the load windings results in a constant current of approximately 50 amperes (Run 8). While this current is within the capacity of the battery field, there still is no control provided, and engine load control and train handling would be difficult.

Note that the current always passes through the reactor windings from odd to even or from 1 to 2 and from 3 to 4. This is a key to the operation of magnetic amplifiers.

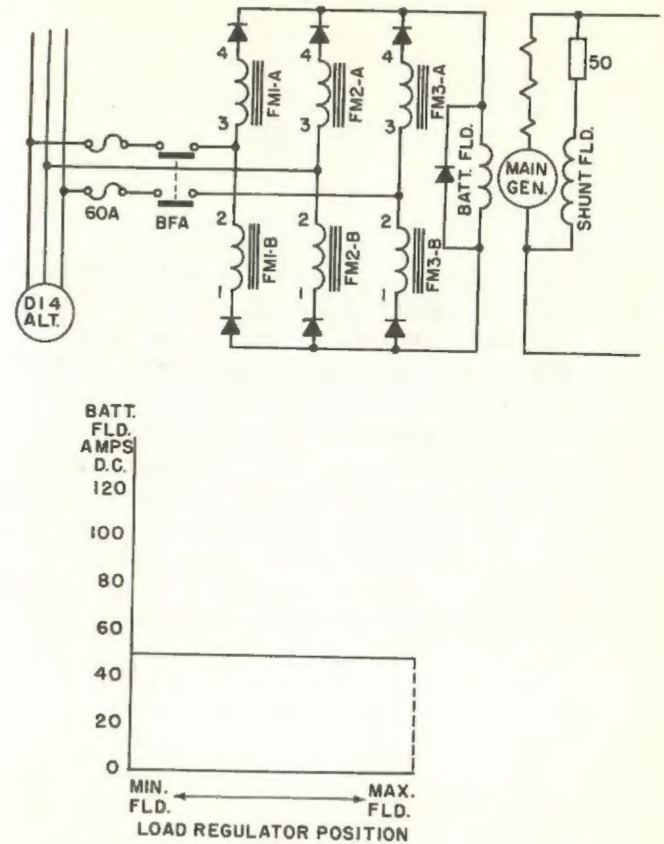


Fig. 1-5 - The Effect Of Using Reactor Load Windings Only

Figure 1-6 shows part of the circuitry required to control the flow of battery field current. This first step of control is the addition of bias current to the reactors. A 200 turn control winding on each reactor is used for this purpose. The winding is excited with 155 milliamperes of control current. This current flows from 8 to 7 or even to odd in this winding. Since current in this direction is in opposition to that flowing in the load windings 1 to 2 and 3 to 4, it opposes the flow of current in the load windings. This increases the impedance of the reactors and results in a flow of only 1.5 amperes in the battery field. This is not sufficient to properly excite the main generator and pull a train.

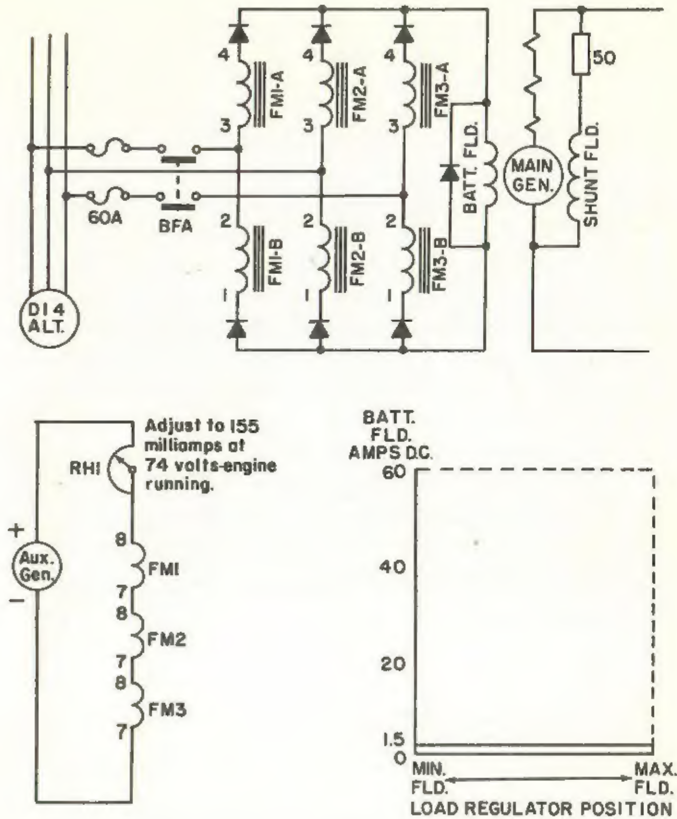


Fig. 1-6 - The Effect Of Using Reactor Bias Windings

In Figure 1-7 complete control of the battery field current is accomplished. The load regulator is used to excite a 500 turn control winding on each reactor in a direction from 11 to 12. This current is in opposition to that flowing in the 8 to 7 windings and results in lowering the impedance of the reactors FM1, FM2, and FM3. When these 11 to 12 windings are excited with a current of 75 milliamperes, a battery field current of 60 amperes will result.

Thus with the load regulator in maximum field, with the engine running, and with 74 volts auxiliary generator voltage, if we adjust RH2 to allow 75 milliamperes to flow in the 11 to 12 windings, the governor will have complete control of the engine load and proper train handling can be accomplished.

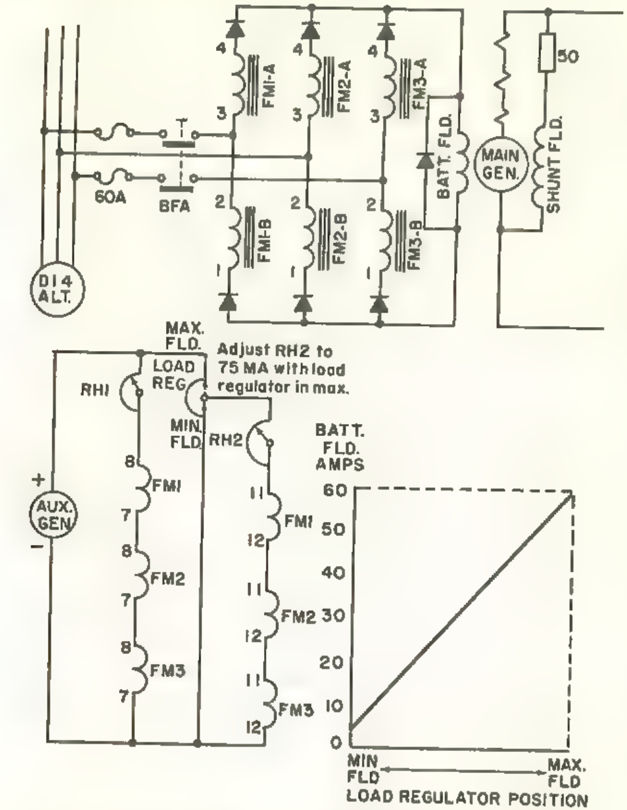


Fig. 1-7 - Effect Of Adding Reactor Drive Or Control Windings

The excitation system described up to this point is similar in characteristic to that realized with the commutator type load regulator, except with an increase in range. The GP30 excitation system, however, operates to compensate for fluctuations in horsepower due to variations in quality and condition of fuel, ambient temperatures and air pressure, and metering of fuel by the injectors. It also acts to adjust the tractive effort of the GP30 to allow it to work to full advantage with older and lower powered locomotives and to enable the older units to operate at speeds that utilize their maximum tractive effort.

The characteristic of the GP30 control system that allows it to compensate for a fluctuation in horsepower due to variables inherent in fuel, air and metering, in effect, overrides the engine governor. The load regulator will rest in maximum field position whenever the compensating characteristic is in effect.

This feature is made up of a main generator voltage transductor GVT, a main generator current transductor MGT, two 4 to 1 transformers T1 and T2, two rectifier bridges CR3 and CR4, two rheostats RH4 and RH7, and a power limit relay PLR.

Figure 1-8 shows how the main generator transductor MGT is used to supply a signal proportional to main generator current.

The cores of two reactors MGT-A and MGT-B, which are gapless, are firmly clamped around the main generator bus. Thus the flux density or degree of saturation of these cores is proportional to the level of current in the main generator bus. It follows then that the level of AC current which will pass through coils wound on these cores will also be proportional to the generator current. This current is passed through the primary winding, X1-X2, of a transformer, T2. If a short circuit is placed across the secondary, H1-H4 of T2, the current in the primary will be proportional to the generator current, but since it is AC, it is difficult to use.

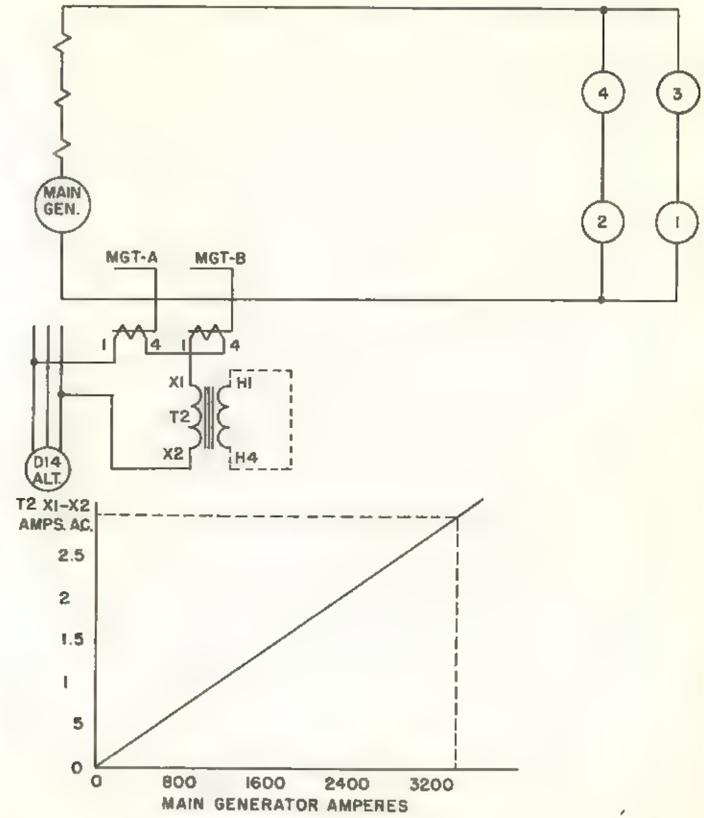


Fig. 1-8 - Current Feedback System

In Figure 1-9 the secondary of the transformer T2 is added to the circuit shown in Figure 1-8. As a step toward making the signal easier to use, the T2 secondary current is rectified through the use of CR3 and is loaded on RH7.

Due to the 1 to 4 transformer ratio, the resultant direct current signal is only 1/4 the value of the AC current in the primary circuit (X1 to X2) in Figure 1-8.

Although the DC signal is proportional to main generator current, past experience has proved that DC current signals are quite difficult to use for control purposes. The following text and illustrations indicate how control is accomplished.

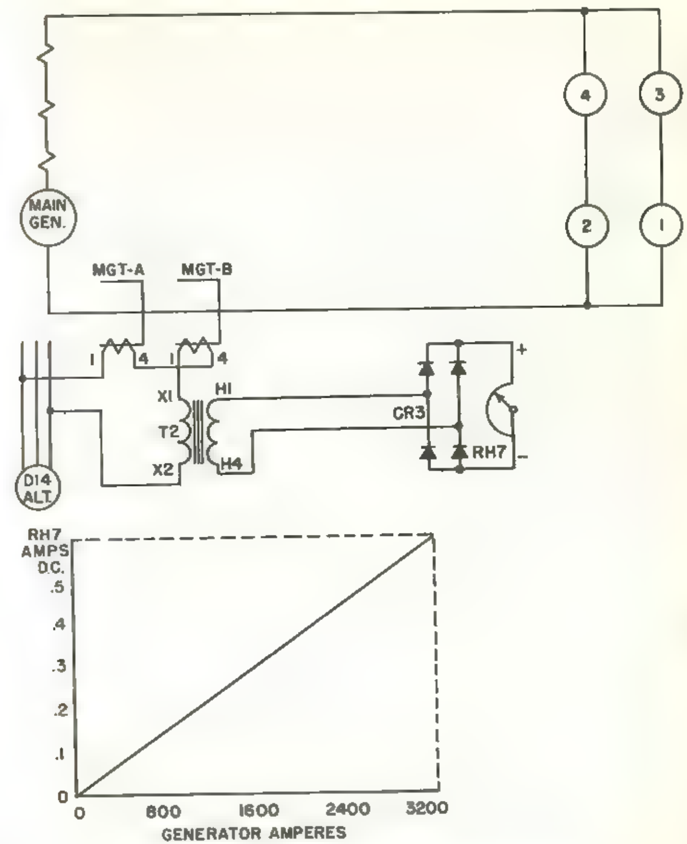


Fig. 1-9 - Current Feedback System

In the circuit shown in Figure 1-10 there is a usable signal in the DC voltage drop across the loading rheostat RH7. If the proper value of resistance is chosen for this rheostat, it can be adjusted to give a 74 volt DC signal at 3400 amperes on the main generator. The main generator can be short circuited for this setting merely by mounting a 3000 ampere meter shunt to the left of the load shunt panel on a bracket provided. RH7 is labeled AMPS FS in the electrical cabinet.

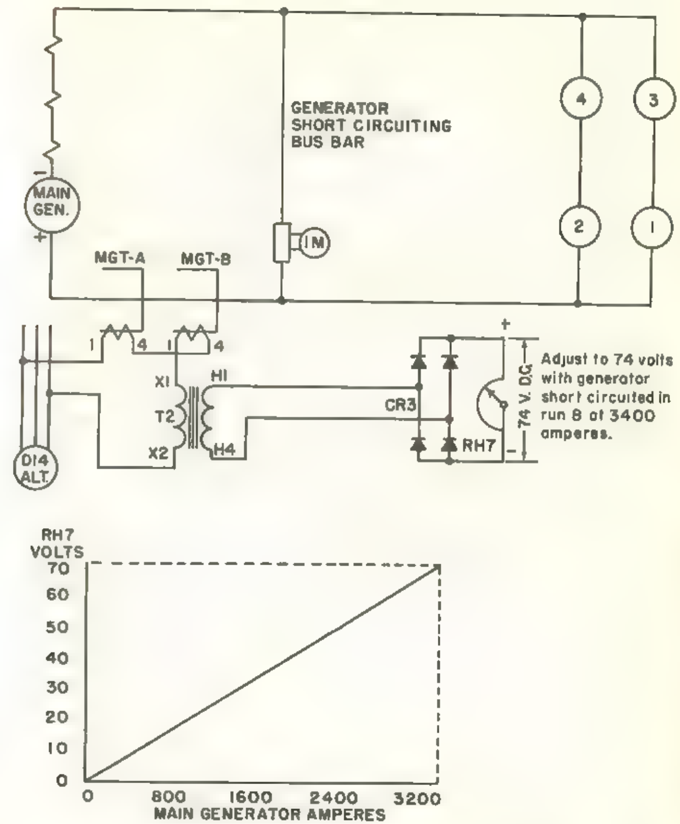


Fig. 1-10 - Current Feedback System

In Figure 1-11 the means have been added to give a DC voltage signal proportional to the main generator voltage in a manner very similar to that used to get the generator current signal.

To obtain the voltage signal a current proportional to generator volts is passed through coils wound on the cores of two transductor reactors GVT-A and GVT-B. As with the MGT, AC current in the secondary coils on these cores will be proportional to the main generator voltage. This current is transformed and rectified and passed through RH4. If an 1850 volt source was available, RH4 could be adjusted to give us a 74 volt DC signal. In practice the RH4 setting can be obtained by cutting out the governor load control and loading the power plant on its own grids or on a load box. The generator voltage and amperage values must then fall on the power limit line. (See graph in lower portion of Figure 1-14.) RH4 is labeled volts FF in the electrical cabinet.

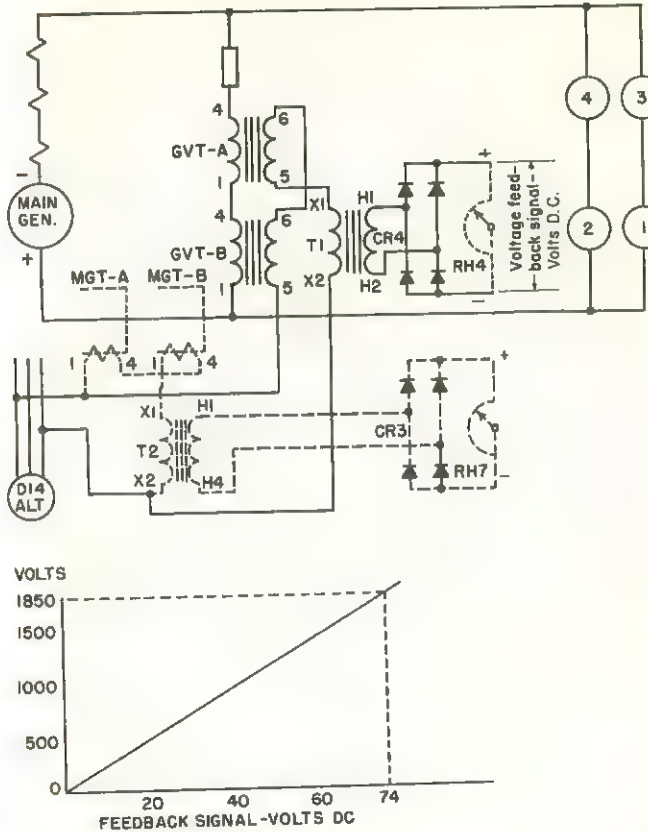


Fig. 1-11 - Voltage Feedback System

In Figure 1-12 the two feedback signals have been connected in series so that their voltages add. The effect of increasing voltage is similar to that obtained by connecting two batteries in series.

If a straight line is drawn between the 1850 volt point where the voltage feedback signal is equal to 74 volts and the 3400 ampere point where the current feedback signal is equal to 74 volts, we will find that the sum of the two signals will be equal to 74 volts at any point on the line.

It is no coincidence that this straight line closely parallels that portion of the 2250 HP curve that is used in the series-parallel motor connection.

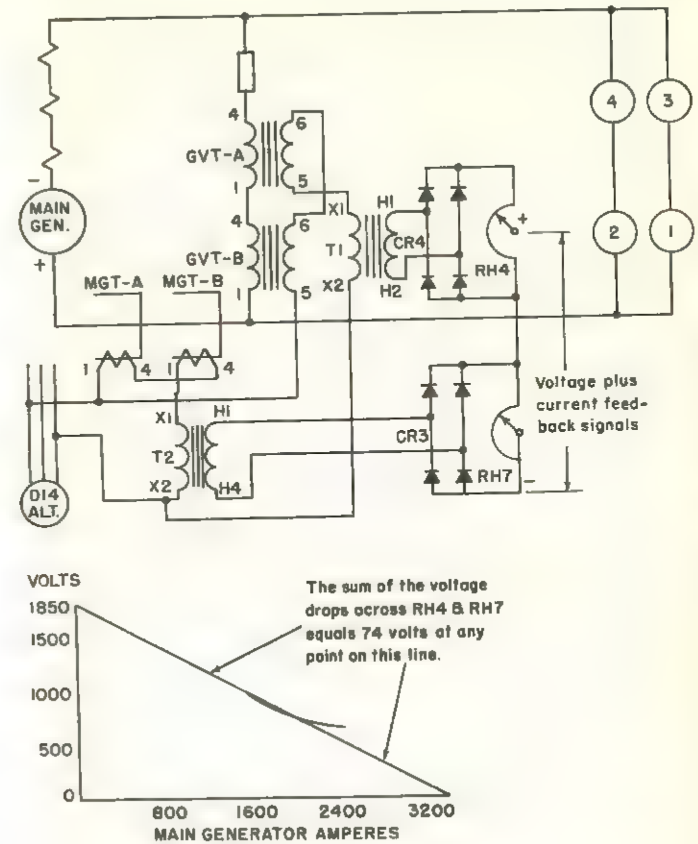


Fig. 1-12 - Current Plus Voltage Feedback Signals

In Figure 1-13 the sum of the two feedback signals is compared to the voltage potential at the load regulator arm. This is done by connecting the two negatives together and tying the positive side of the feedback signal to the load regulator arm through the coil of a polarized relay, PLR. Thus any unbalance in voltage between the load regulator arm and the feedback signal will result in a current flow in the PLR coil. Current flow from 1 to 3 or zero current in PLR coil will cause PLR contacts 8 and 2 to open. This results in a major reduction in magnetic amplifier drive current, and the battery field excitation is reduced, with a resultant reduction in generator output.

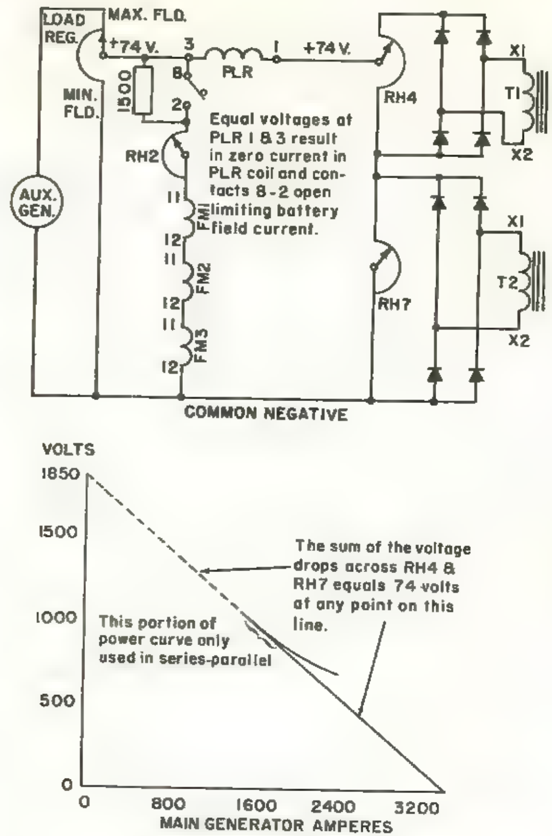


Fig. 1-13 - Power Limit Relay Operation

Figure 1-14 depicts a condition where the engine output is such as to result in a feedback signal of only 55 volts. Since with the load regulator in maximum field the voltage at its arm is 74 volts as compared to the 55 volt feedback signal, current flows from 3 to 1 in PLR coil. PLR contacts 8 and 2 close, resulting in full drive to the magnetic amplifier, hence full battery field excitation.

It follows then that the governor can control the load on the engine merely by moving the load regulator to a position which results in a feedback signal corresponding to the desired load.

The system reacts so rapidly that fluctuation in power output is insignificant.

The second function of the adhesion control system, that of adjusting the power to that of older units for drag service, is accomplished by changing the slope of the feedback signal line. This is done through the use of rheostats RH5 and RH6 and FSA contacts G-H and J-K. (See locomotive wiring diagram.) The anchor points for this line are 2300 volts and 2900 amperes main generator.

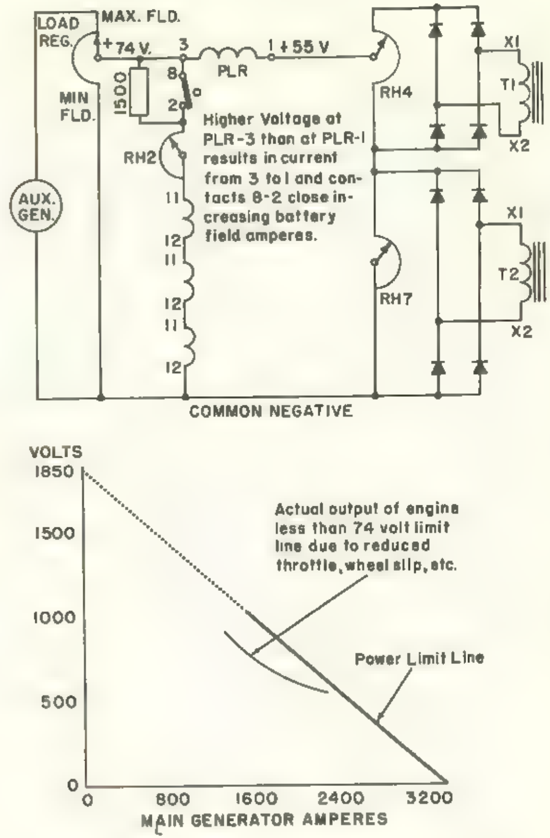


Fig. 1-14 - Power Less Than Limit

SECTION 2

TRANSITION CONTROL

The GP30 locomotive utilizes ten transition positions to cover its speed range from 12 to 71 miles per hour (62-15 gear ratio). These positions are as follows:

1. Series Parallel - Full Motor Field Strength
2. Series-Parallel - 24% Motor Field Shunt
3. Series-Parallel - 40% Motor Field Shunt
4. Series-Parallel - 49% Motor Field Shunt
5. Series-Parallel - 54% Motor Field Shunt
6. Series-Parallel - 60% Motor Field Shunt
7. Series-Parallel - 65% Motor Field Shunt
8. Parallel - Full Motor Field Strength
9. Parallel - 40% Motor Field Shunt
10. Parallel - 54% Motor Field Shunt

These 10 transition positions or steps are automatically controlled by two E-I type transition relays, FTR and BTR. Forward transition relay, FTR, by picking up, initiates all forward transitions during a train acceleration. Backward transition relay, BTR, by dropping out, initiates all backward transitions during train deceleration.

Considerable circuit simplification is accomplished through the use of a multiple pole ten position motor driven cam switch called a program switch. This device derives its name from its function of programing the locomotive through ten transition positions.

Three motor field shunting contactors FS1, FS2, and FS3 are used in combination to accomplish the six steps of motor field shunting. These combinations are as follows:

FS1	24%	Motor Field Shunt
FS2	40%	Motor Field Shunt
FS1 - FS2	49%	Motor Field Shunt
FS3	54%	Motor Field Shunt
FS1 - FS3	60%	Motor Field Shunt
FS2 - FS3	65%	Motor Field Shunt

Each of these contactors, as well as the transition relay TR, is controlled by its own switch on the program switch. These switches are designated PS1 through PS8.

PS1 is used in conjunction with a directional relay DR to position the cam shaft of the program switch in the exact center of each of the 10 positions. PS1 is closed only between positions and opens in the center of each position. The remaining seven switches open or close a minimum of five degrees ahead of PS1. This insures that all the remaining switches are in the proper position when the program switch is at rest.

The cam development for the program switch is shown below:

■ Indicates Closed Contact.

Switch No.	POSITION 1	2	3	4	5	6	7	8	9	10
PS1	■	■	■	■	■	■	■	■	■	
PS2		■	■	■	■	■	■	■	■	■
PS3		■		■		■				
PS4			■	■			■		■	
PS5					■	■	■			■
PS6								■	■	■
PS7	■	■	■	■	■	■				
PS8	■	■	■	■	■	■	■	■	■	

Figure 2-1 shows the transition control circuit with the program switch in position 1. The motors are connected in series-parallel full field and, since the locomotive is moving at a very low speed, neither the FTR nor the BTR relays are picked up.

PS2, which is open in position 1, prevents energy from reaching the program switch drive motor armature.

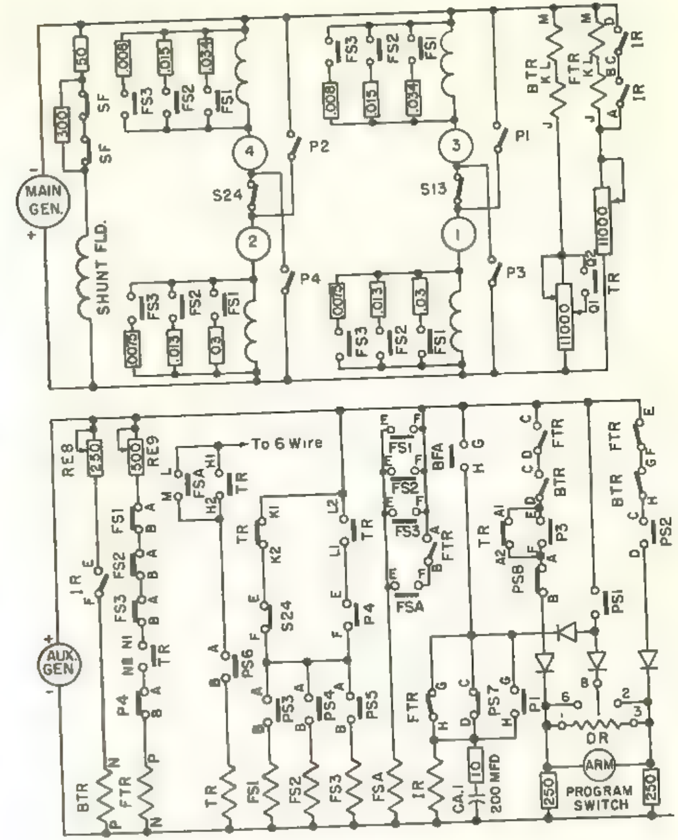


Fig. 2-1 - Starting A Train

In Figure 2-2 the locomotive has accelerated the train to a speed resulting in a voltage of 925 at approximately 1700 main generator amperes. At this point BTR picks up, but since both FTR and BTR must be picked up to energize the program switch armature, nothing happens at this point.

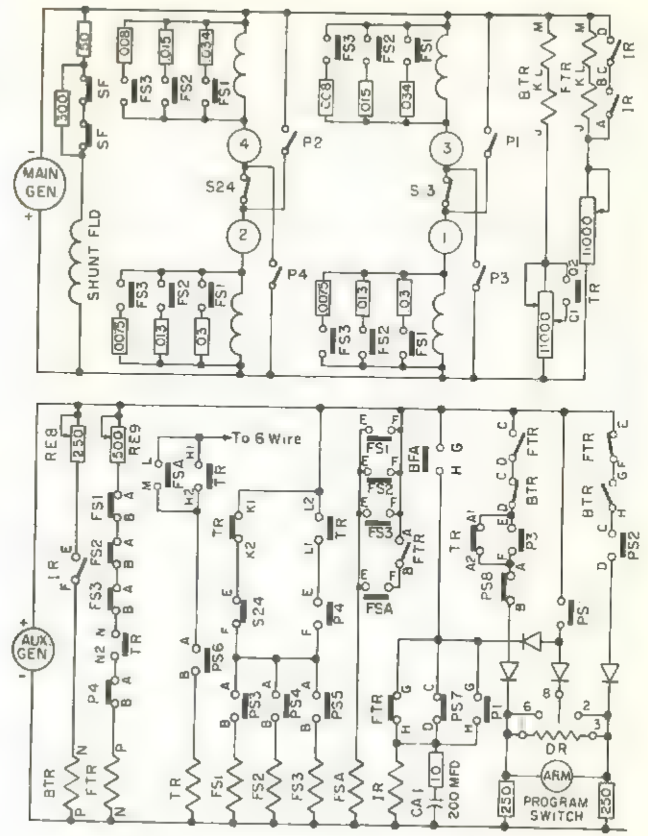


Fig. 2-2 - Accelerating — BTR Picks Up

In Figure 2-3 the locomotive has reached a speed of 19 MPH. The FTR relay picks up at approximately 980 volts and 1600 amperes out of the main generator. FTR contacts C-D closing allows current to flow from the positive side of the auxiliary generator, through BTR C-D, TR A1-A2, PS8 A-B contacts, and through the motor armature in a direction to cause the program switch to rotate from position 1 toward position 2.

The voltage drop across the motor armature causes a current to flow from 1 to 3 in the coil of the directional relay DR. This causes DR contacts 8 and 6 to close.

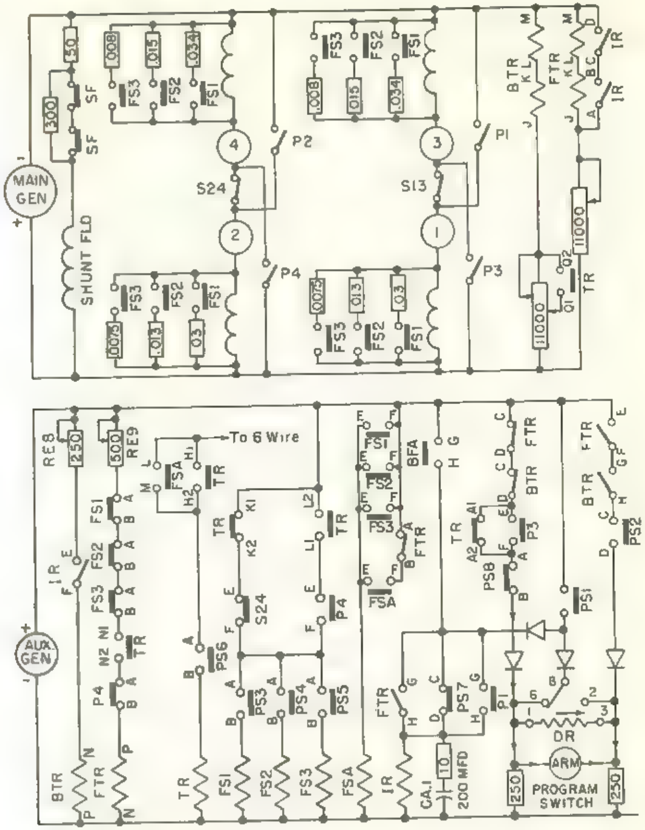


Fig. 2-3 - Accelerating — FTR Picks Up

The program switch is now moving from position 1 toward position 2. It will require less than one second to reach the center of position 2. Figure 2-4 shows the conditions existing after approximately 8 degrees of rotation. At this point, as can be seen from the cam development chart, PS1 contacts close.

Since PS7 contacts are closed at this time, interrupter relay IR picks up immediately. IR contacts A-B and C-D closing shorts out FTR J-K and L-M coils, but at this point FTR is still picked up. IR contacts E-F closing energizes BTR N-P coil with 300 milliamperes of control current, thus holding BTR picked up.

The program switch armature continues to rotate toward position 2.

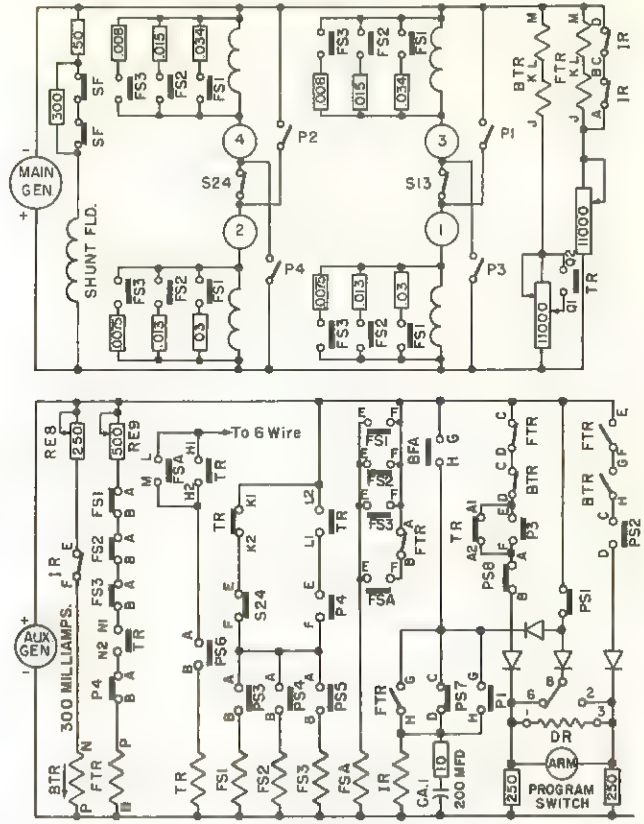


Fig. 2-4 - Accelerating — PS1 Contacts Close

In Figure 2-5 FTR has fallen out due to IR shorting its J-K and L-M coils. FTR C-D contacts are now open, but the motor armature continues to rotate toward position 2 since it now gets its energy through PS1 and DR 8-6 contacts.

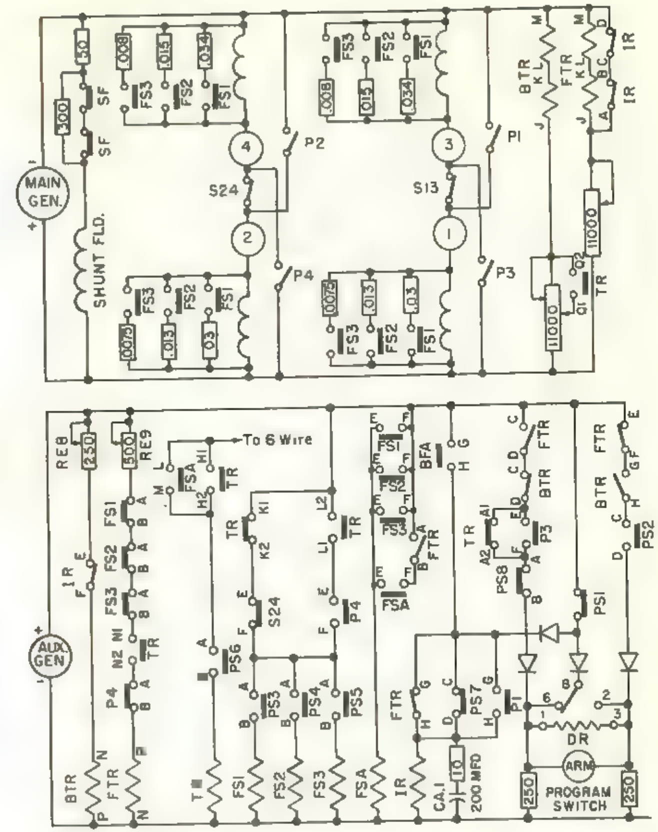


Fig. 2-5 - Accelerating — FTR Falls Out

As the program switch continues to rotate toward position 2, it reaches a point approximately 25 degrees from position 1 as shown in Figure 2-6. At this point PS2 and PS3 contacts close. PS2 contacts closing merely establishes a circuit to drive the program switch backward, but since BTR G-H contacts are open, it has no affect at this time.

PS3 A-B contacts closing picks up FS1. FS1 main contacts closing shunts approximately 24% of the motor armature current around the motor fields through the 0.03 and 0.034 ohm resistors.

FS1 E-F interlocks close but at this instant FSA has not yet picked up. The program switch continues to rotate toward the center of position 2.

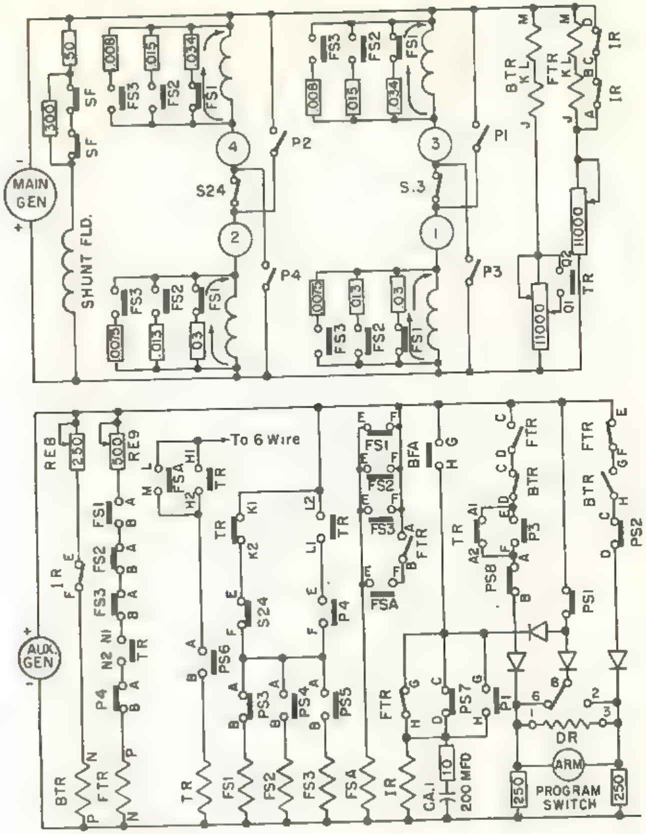


Fig. 2-6 - Stepping Up — FS1 Picks Up

In Figure 2-7, the program switch has reached a point within 5 degrees of the center of position 2. At this point PS1 contacts open. This interrupts the flow of current to the program switch motor armature. Since this motor has permanent magnet field poles, a current is generated by the rotation of the armature in these fields. This current is dissipated in the two 250 ohm resistors below the armature and acts as a dynamic brake which stops the armature abruptly.

PS1 opening interrupted the circuit to the IR relay, but it is held picked up by the energy stored in the 200 microfarad capacitor CA1.

In the meantime, FSA relay has picked up.

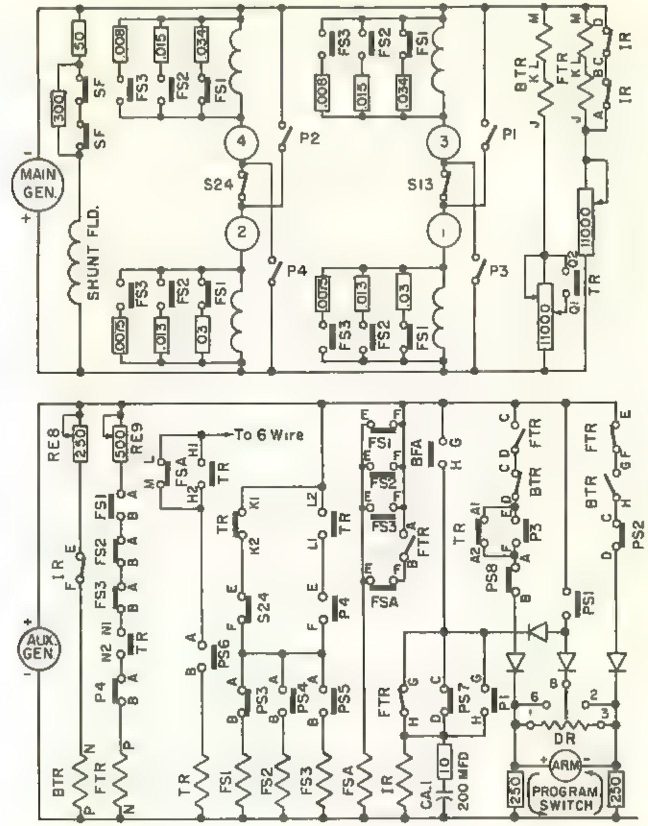


Fig. 2-7 - Program Switch Stops In Position 2

In Figure 2-8 approximately one second has passed since PS1 contacts opened. Due to the weakening of the traction motor fields, the system voltage has dropped to approximately 925 volts.

IR has dropped out removing the shunt from around FTR coils and removing the control energy from BTR N-P coil. FTR does not pick up since the voltage at 925 is below its pickup which is 980. BTR does not fall out since the voltage is above its dropout point which is 875 volts.

FS1 is held picked up by PS3 which is always closed in position 2. FSA is held in by FS1 E-F interlocks.

PS2 makes it possible for BTR to drive the program switch to position 1 should BTR drop out due to a loss of train speed.

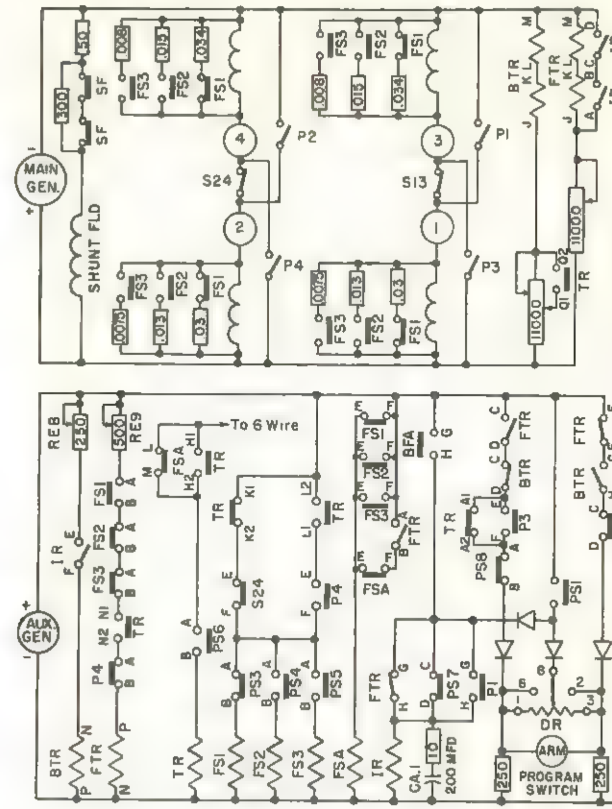


Fig. 2-8 - In Position 2 — IR Falls Out

As the locomotive continues to accelerate, the program switch will step up to position 7 when the FTR picks up. These steps are identical to going from position 1 to position 2.

In Figure 2-9 the position of the various contactors is shown after the program switch has stopped in position 3 and the IR relay has dropped out.

The traction motor fields are now shunted approximately 40% and the system voltage is 910 volts.

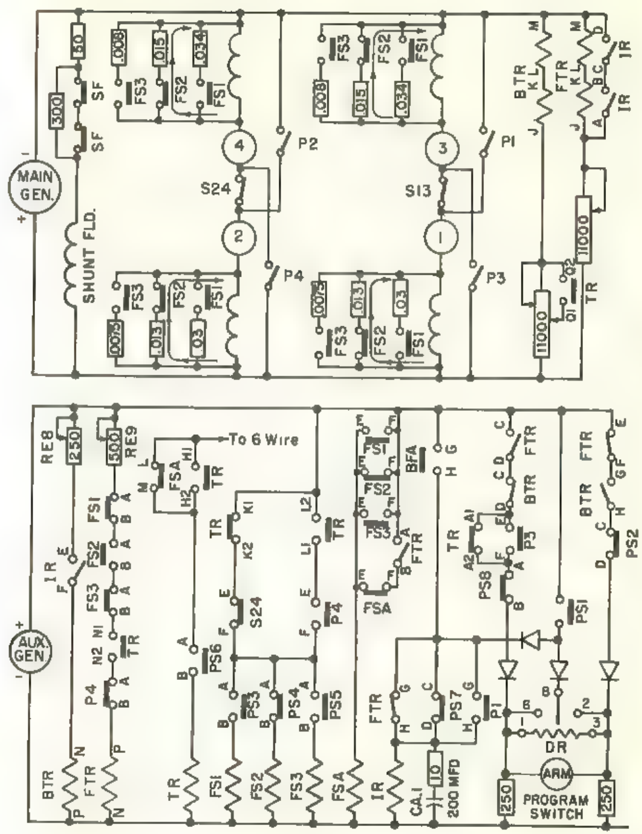


Fig. 2-9 - In Position 3 — 40% Shunt

As the locomotive continues to accelerate, the program switch has moved to position 4, as shown in Figure 2-10. FS2 remains picked up and FS1 is picked up again, putting the 0.03 and 0.013 ohm resistors in parallel across the motor fields (0.034 and 0.015 ohms for number 2 truck). This results in an effective resistance of 0.0091 ohms for No. 1 and 0.0104 ohms for No. 2 truck.

Since the system voltage drops only to 920 volts due to the 49% shunt, FTR does not pick up nor does BTR drop out.

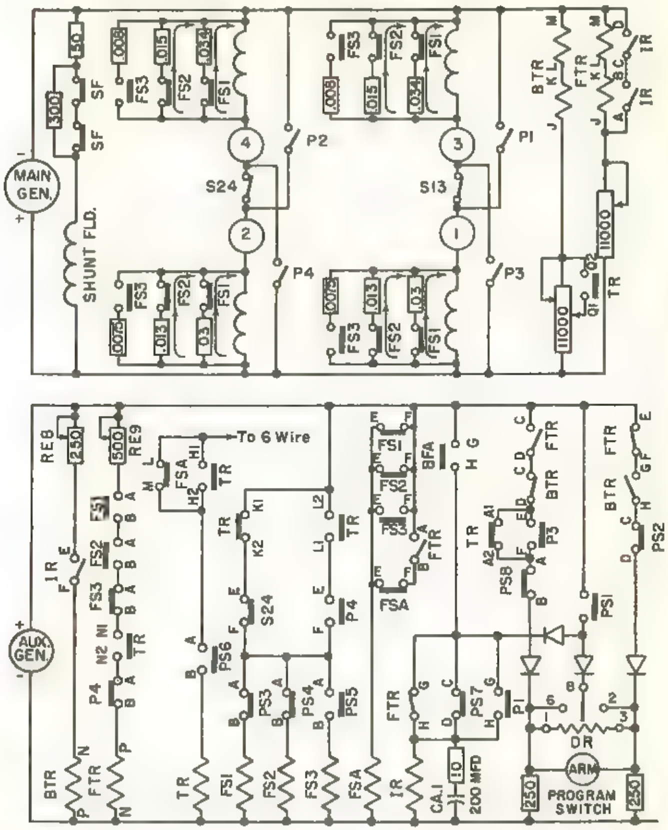


Fig. 2-10 — In Position 4 — 49% Shunt

In Figure 2-11 the program switch is shown stopped in position 5. FS1 and FS2 have dropped out and FS3 has picked up, shunting the motor fields with a 0.0075 ohm (No. 1 truck) and a 0.008 ohm (No. 2 truck) resistor. This results in approximately 54% motor field shunt.

As a result, the system voltage has dropped to 935 volts.

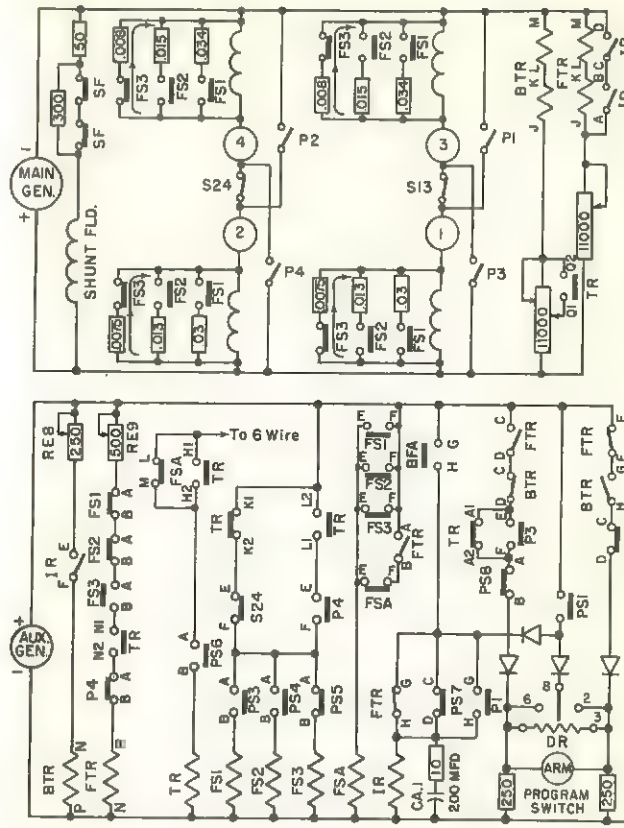


Fig. 2-11 - In Position 5 — 54% Shunt

In position 6, Figure 2-12, FS3 remains picked up and FS1 picks up and parallels the 0.008 ohm resistors with the 0.034 ohm resistors. This results in an effective resistance of approximately 0.0065 ohms and shunts the motor fields approximately 60%.

The resultant drop in traction motor field strength drops the system voltage to approximately 925 volts.

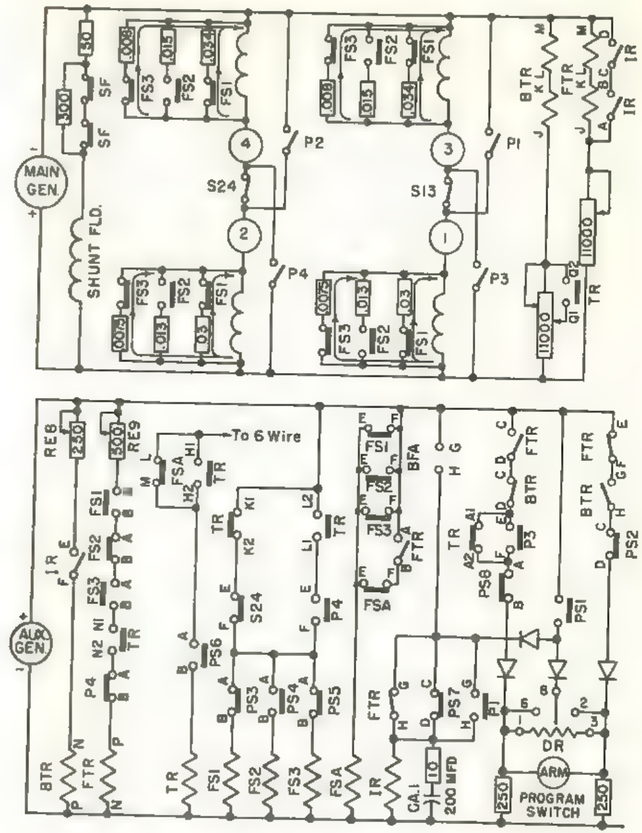


Fig. 2-12 - In Position 6 — 60% Shunt

In Figure 2-13 the program switch is shown at rest in position 7. FS1 has dropped out and FS3 and FS2 have closed, putting the 0.008 and 0.015 ohm resistors in parallel across the motor fields. This results in an effective resistance of approximately 0.0052 ohms and a 65% shunt of the motor fields.

Thus, six steps of motor field shunt are accomplished using only three contactors. This is similar to obtaining 8 locomotive throttle positions using only 4 governor solenoids.

The field strength results in a system voltage of approximately 925 volts.

Note that PS7 contacts are open in position 7. This did not interrupt the sequence of the program switch, since PS1 closed approximately 17 degrees before PS7 opened. This allowed more than enough time for IR to pick up and short out FTR.

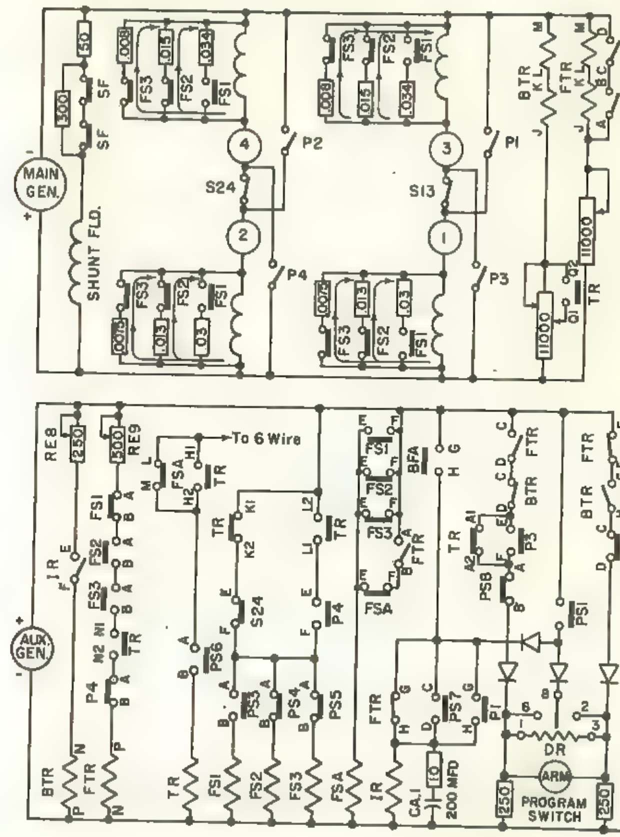
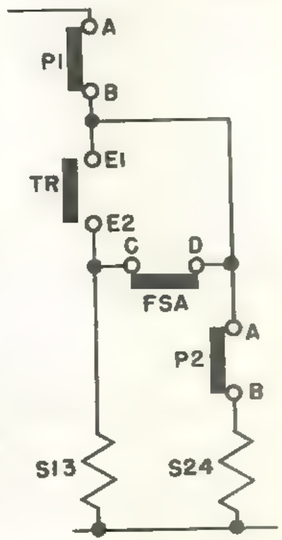


Fig. 2-13 - In Position 7 — 65% Shunt

As shown in Figure 2-14 the program switch has moved to position 8 but transition from series-parallel to parallel motor connection has not yet taken place. The series contactors are still closed.

Since PS7 contacts are now open, IR did not pick up during the movement from position 7 to position 8. IR did not short out FTR, and it is still picked up.

FS2 and FS3 have dropped out and their A-B interlocks, being closed, have recalibrated FTR to drop out at 500 volts by energizing its P-N coil with 94 milliamperes control current at 74 volts.



TR is picked up but neither SF nor BFA has fallen out at this point.

Although FTR and BTR are still picked up, the program switch is prevented from moving toward position 9 by TR A1-A2 contacts which are now open.

FSA is held picked up by FTR A-B contacts. FSA C-D contacts (shown at right) prevent transition from taking place by holding S13 picked up, even though TR E1-E2 contacts are open.

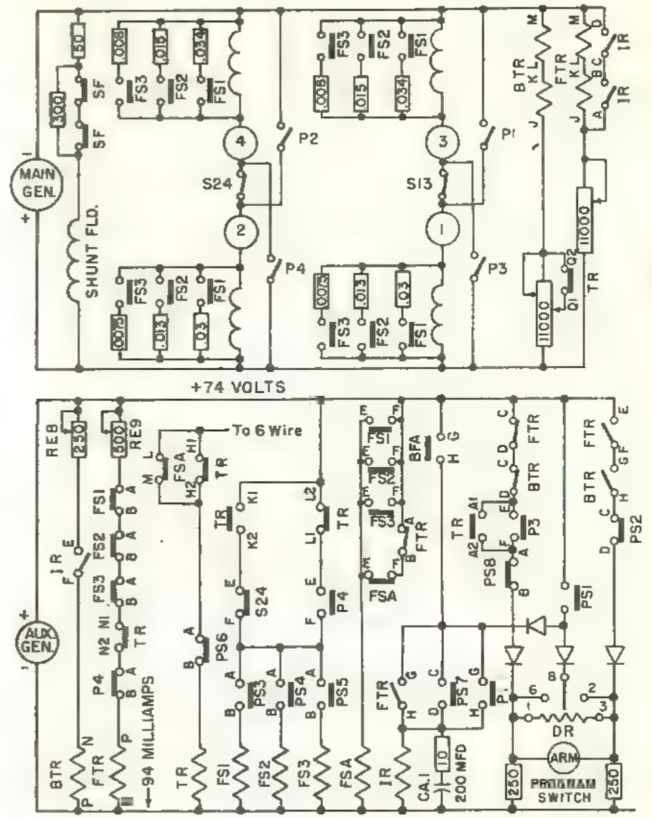


Fig. 2-14 - In Position 8 — TR Picked Up

Figure 2-15 shows the next step toward accomplishing the series-parallel to parallel motor transition. SF has opened, inserting 300 ohms resistance into the shunt field circuit. SF opening dropped BFA which removed all energy from the main generator battery field. (See Figure 1-7 under excitation system.) The system voltage drops at a rate which requires approximately 2-1/2 seconds to drop from 980 to 500 volts.

The power reduction is controlled at this rate as a means of making the transition as smooth as possible without loss of speed.

At this instant the voltage is still above the 500 volt dropout point of FTR, and FTR is still picked up.

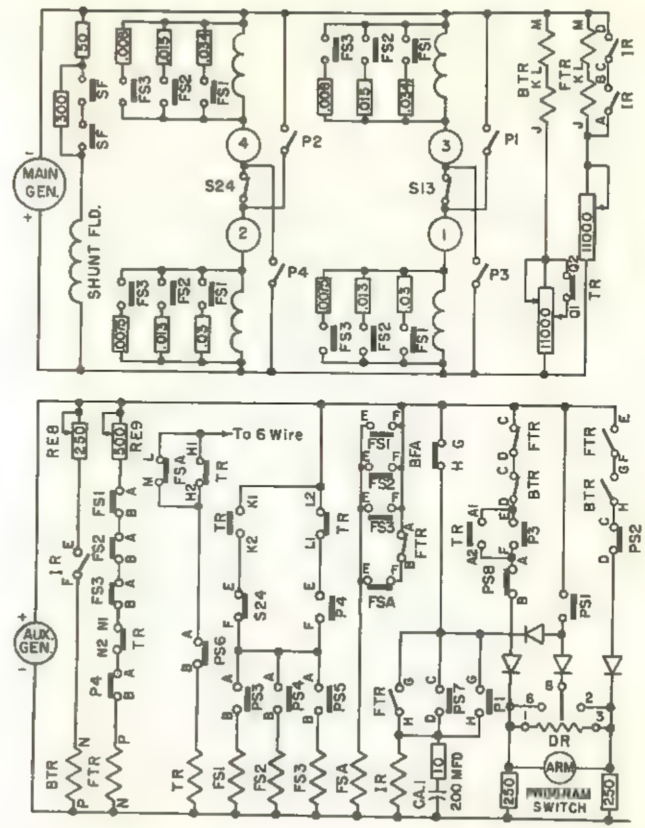


Fig. 2-15 - In Position 8 — SF And BFA Open

In Figure 2-16, the voltage has dropped to the 500 volt drop out of FTR, and FTR has fallen out.

FTR G-H contacts closing picks up IR, since BFA G-H interlocks are now closed. IR shorts out FTR coils during transition by energizing its N-P coil with 300 milliamperes control current.

FTR A-B contacts opening drops FSA, and S13 is now free to fall out since FSA C-D contacts are open.

Transition from series-parallel to parallel will now take place in a manner identical to GP20 and late GP9 locomotives.

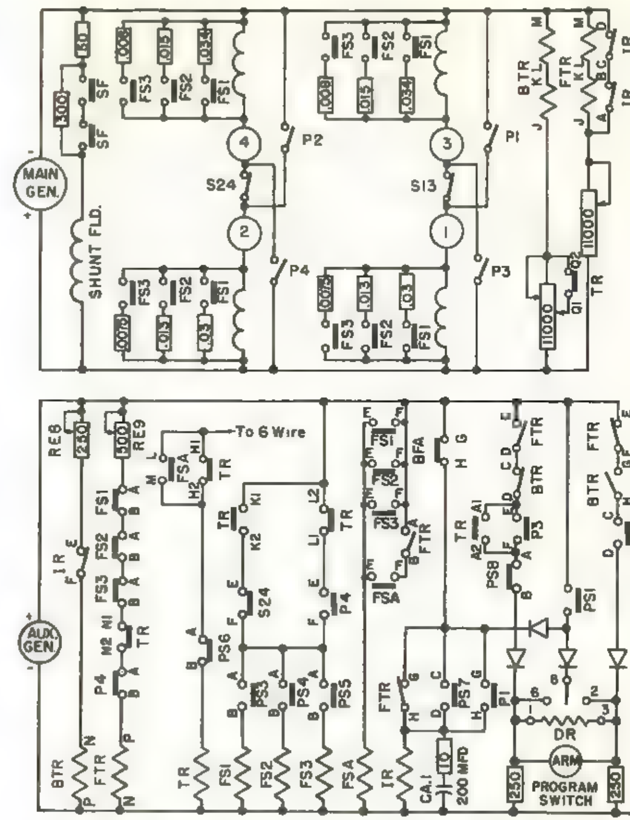


Fig. 2-16 - Voltage At 500 — FTR Falls Out

In Figure 2-17 transition to parallel is shown completed and both SF and BFA contactors have picked up. Power which had dropped during transition is being recovered by the engine governor and load regulator.

IR is held in by energy in capacitor CA1. This holds FTR out and BTR picked up until the voltage and current have recovered.

The program switch is still in position 8 and no FS contactors are called for.

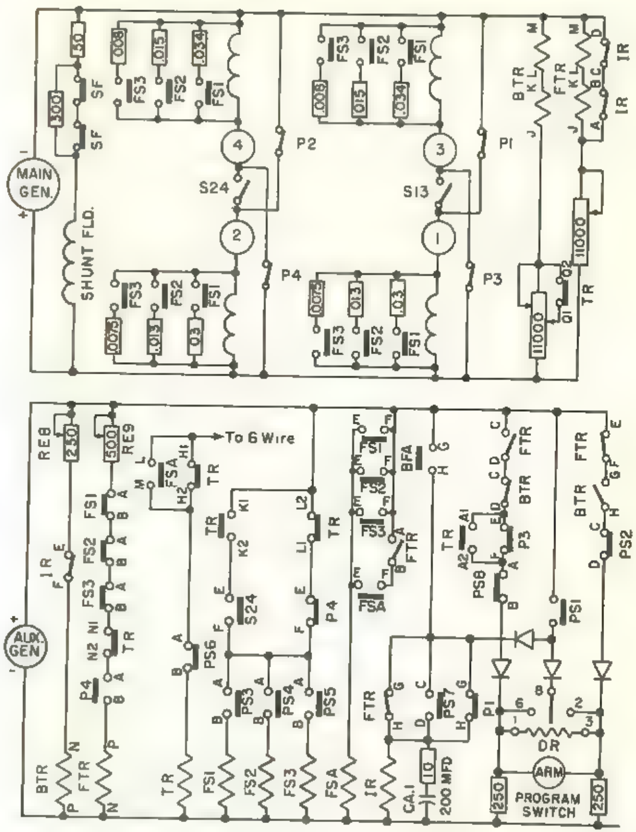


Fig. 2-17 - Parallel Motors — IR Still Picked Up

In Figure 2-18 IR has dropped out, and the power output is back at steady state condition.

FTR is now free to pickup, and BTR is free to drop out, except that the dropout of BTR is now recalibrated to approximately 660 volts by TR Q1-Q2 contacts, which are closed.

The system voltage is now approximately 735 volts, which is below the pickup of FTR and above the dropout of BTR.

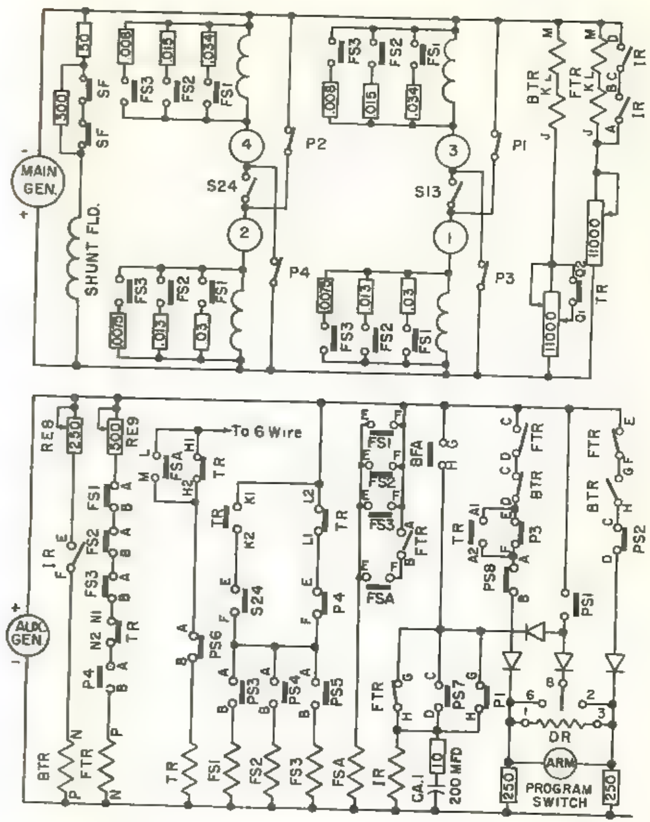


Fig. 2-18 - Parallel Motors — IR Drops Out

As the locomotive continues to accelerate, at approximately 46 MPH the system voltage reaches the pick up value of FTR and the program switch moves to position 9.

Figure 2-19 shows the condition of the control after the program switch has come to rest in position 9 and IR has fallen out.

FS2 has picked up since PS4 contacts are closed. This, as in position 3, results in 40% motor field shunt.

The system voltage has dropped to 790 volts.

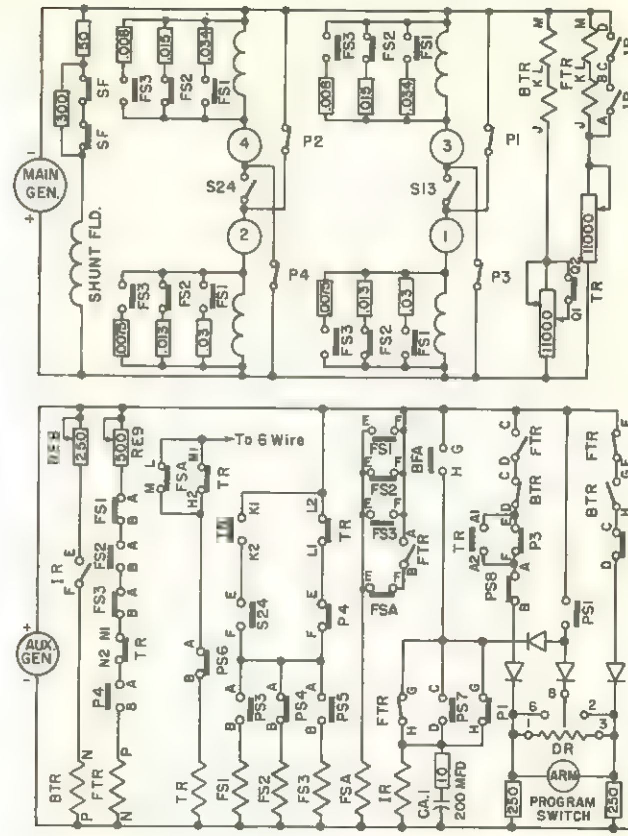


Fig. 2-19 - In Position 9 - Parallel 40% Shunt

The program switch moves to its last position, #10, at approximately 65 MPH.

The attitude of the contact points of the various control devices after the program switch has come to rest and IR has dropped out is shown on Figure 2-20.

FS3 has picked up and FS2 has dropped out, because PS5 is closed and PS4 is open in position 10.

PS8 contacts are now open preventing the program switch from moving from position 10 to position 1 in the event FTR should pick up.

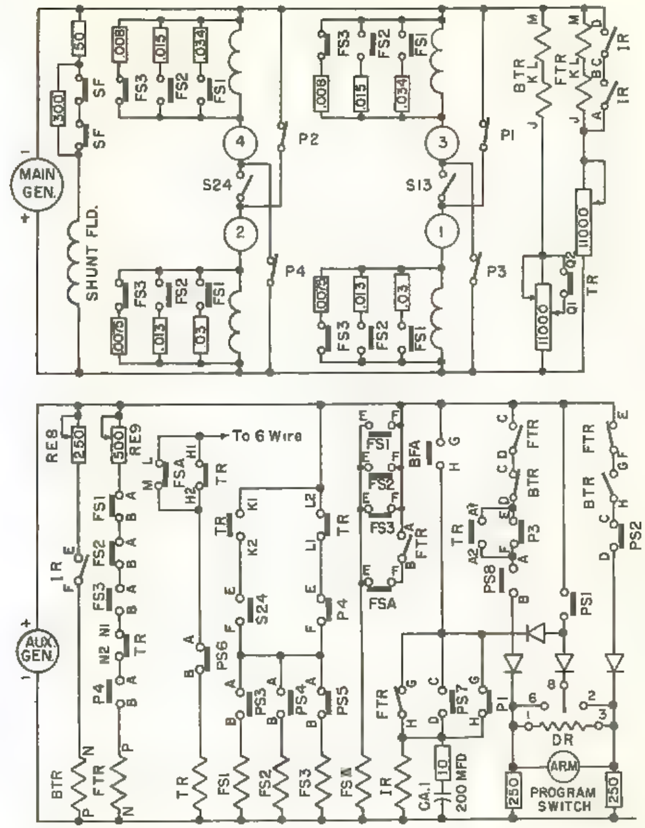


Fig. 2-20 - In Position 10 — Parallel 54% Shunt

In position 10, should the locomotive decelerate due to an increase in grade, the program switch will step down in a manner similar to its stepping up.

In Figure 2-21, the locomotive has decelerated to a point where the system voltage has dropped to the 660 volt dropout valve of BTR. BTR has dropped out. FTR had not picked up in position 10. The program switch armature is energized in a direction to start it rotating toward position 9.

Simultaneously current from 3 to 1 in DR coil causes its contacts 8 and 2 to close.

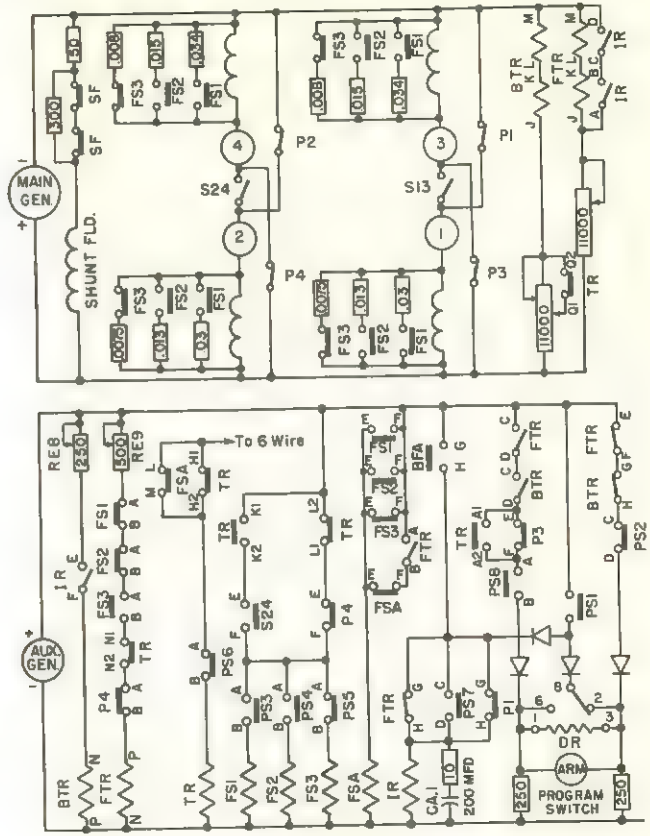


Fig. 2-21 - In Position 10 — BTR Drops Out

In Figure 2-22 the program switch has moved approximately 8 degrees toward position 9.

PS1 contacts have closed.

IR relay has picked up, shorting out the FTR coils and energizing BTR N-P coil with 300 milliamperes control current. BTR has not yet picked up.

The program switch continues to rotate toward position 9.

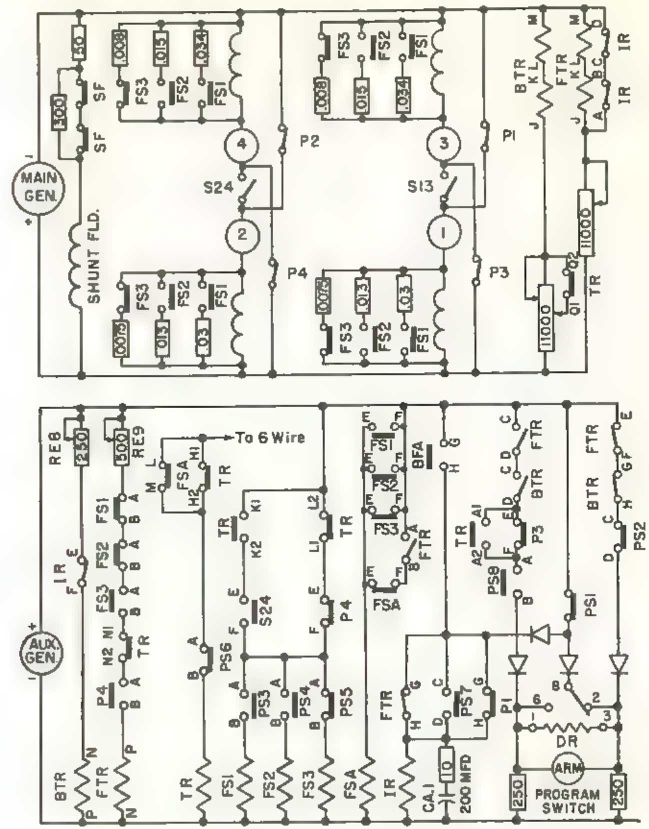


Fig. 2-22 - Stepping Down — PS1 Closes

In Figure 2-23 BTR has picked up due to the 300 milliampere control current in its N-P coil.

The program switch motor armature now gets its energy through PS1 and DR 8-2 contacts, and it continues to rotate toward position 9.

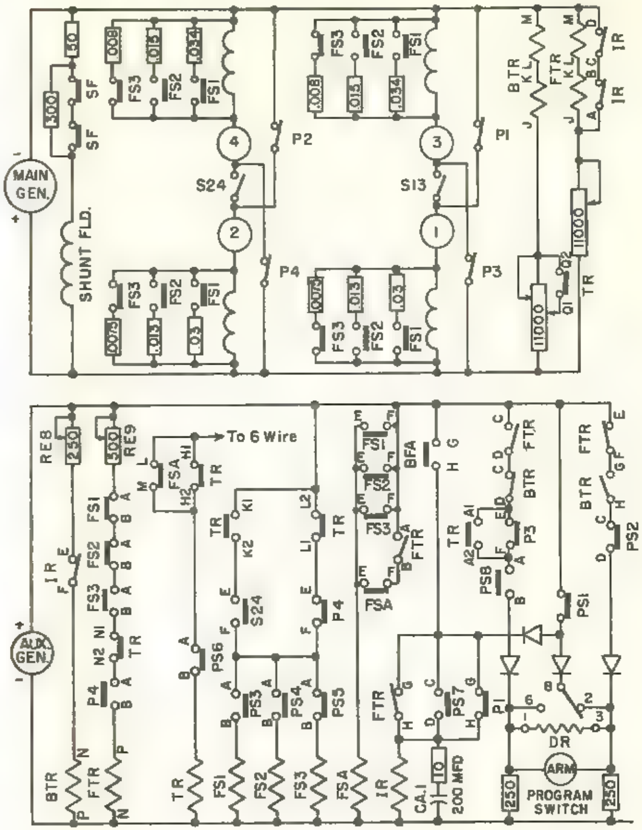


Fig. 2-23 - Stepping Down — BTR Picks Up

In Figure 2-24 the program switch has moved approximately 25 degrees toward position 9.

PS5 has opened and PS4 has closed, and as a result FS3 has dropped out and FS2 has picked up. As in position 3 the motor fields are shunted 40%.

The program switch continues to rotate toward the center of position 9.

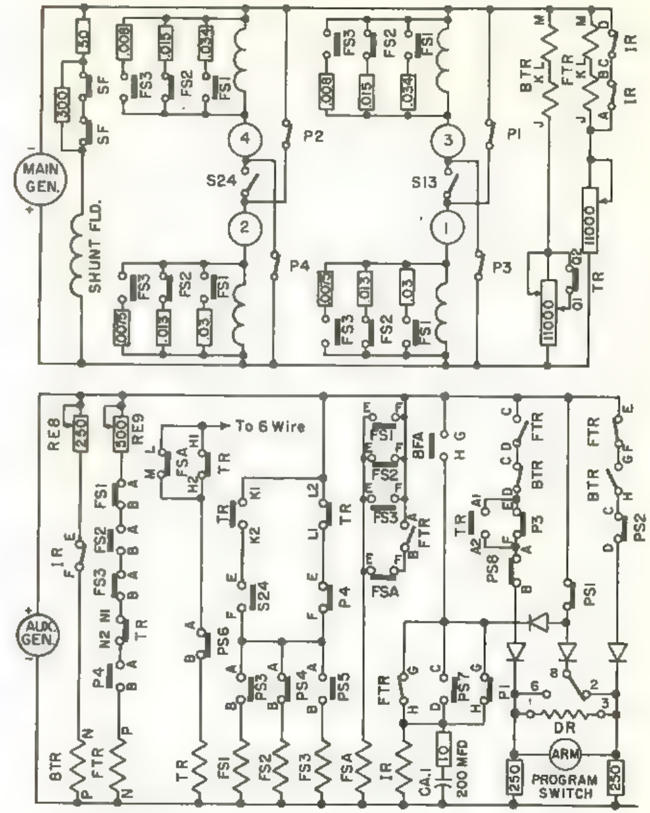


Fig. 2-24 - Stepping Down — FS3 Out - FS2 In

In Figure 2-25 the program switch has reached a point within 5 degrees of the center of position 9. PS1 opened, stopping the program switch abruptly.

DR contacts 8 and 2 have opened. PS1 interrupted the circuit to IR, but it is still held picked up by CA1.

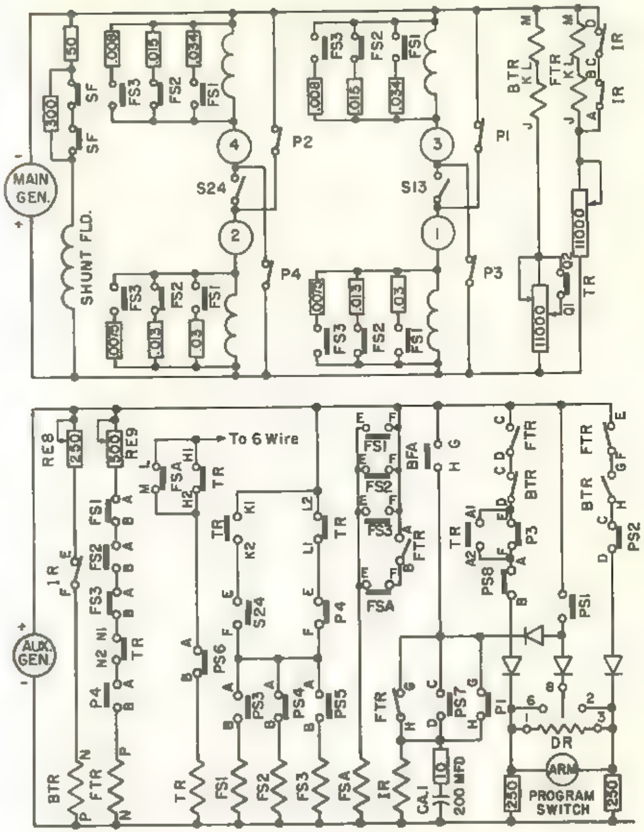


Fig. 2-25 - In Position 9 — IR Still Picked Up

In Figure 2-26 one second has elapsed since PS1 opened and the program switch stopped near the center of position 9.

IR has dropped out and BTR is held in by the system voltage which is now approximately 750 volts.

Should the locomotive continue to decelerate due to the grade, the program switch will step down to the position corresponding to the balance speed of the locomotive on the hill.

Since the sequence of events in each step is identical to that occurring when going from position 10 to 9, details are not shown here.

Should the grade lessen, the program switch is free to step back up to position 10 as dictated by the pickup of FTR.

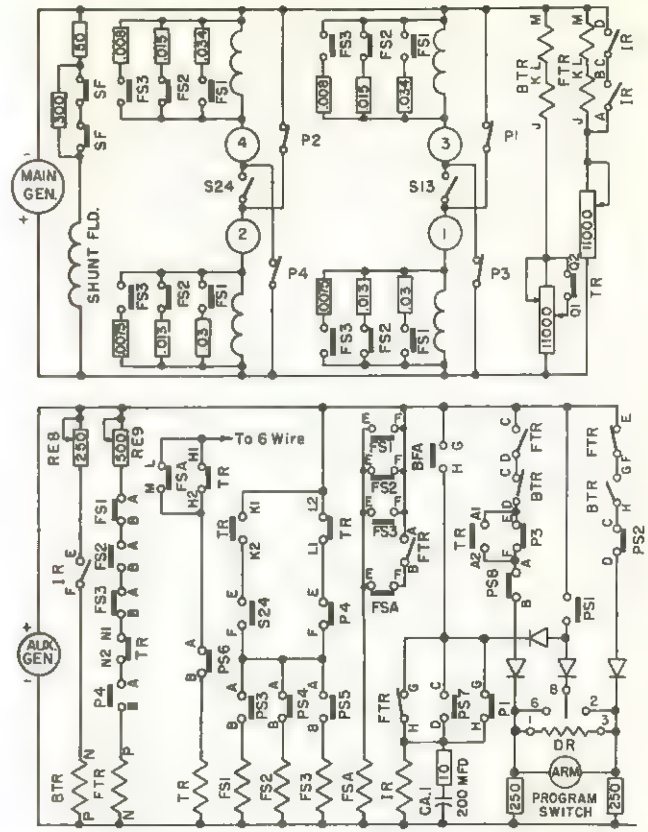


Fig. 2-26 – In Position 9 — Parallel 40% Shunt

SECTION 3

DYNAMIC BRAKE CONTROL

In dynamic brake, the traction motors are reconnected as separately excited generators. The fields are connected in series across the main generator. The motor armatures are loaded on fixed grid resistors and the torque required to drive the armatures is derived from the motion of the train along the rails.

Two armatures are connected in series across two grids so that their voltages can be compared to detect wheel slide. On the GP-30, 0.86 ohm loading resistance per motor is used. This results in a 30% increase in braking effort. This increase in armature output requires that the motor fields be excited with a higher current than formerly. The increased load on the motors makes it necessary to run the engine in Run 5 to provide sufficient ventilation.

Dynamic brake control consists of two (2) main categories:

1. The manual control which the locomotive operator has over the amount of brake used.
2. Automatic armature current limit to protect the armatures and grids from overload.

The operation of these two phases of control is shown in detail on the following pages. The manual control will be explained first.

Figure 3-1 shows the locomotive circuits connected for dynamic brake with the selector handle still in the "B" position. The sequence of going from power to brake is not shown since it is unchanged from GP20 and late GP9 locomotives.

Since the load regulator is not used in dynamic brake on the GP30, the brake relay, BR, is connected to "B" wire directly and the ORS check circuit is eliminated.

The series contactors S13 and S24 are closed. Residual armature current is held to a minimum by connecting the generator shunt field in reverse across the auxiliary generator. The current is limited to that required to buck the generator residual by the 500 and 350 ohm resistors on either side of the shunt field.

The brake relay has transferred the magnetic amplifier drive coils from the load regulator to the 24T wire. However, since the brake control rheostat is still in the minimum position, no energy is applied to these coils.

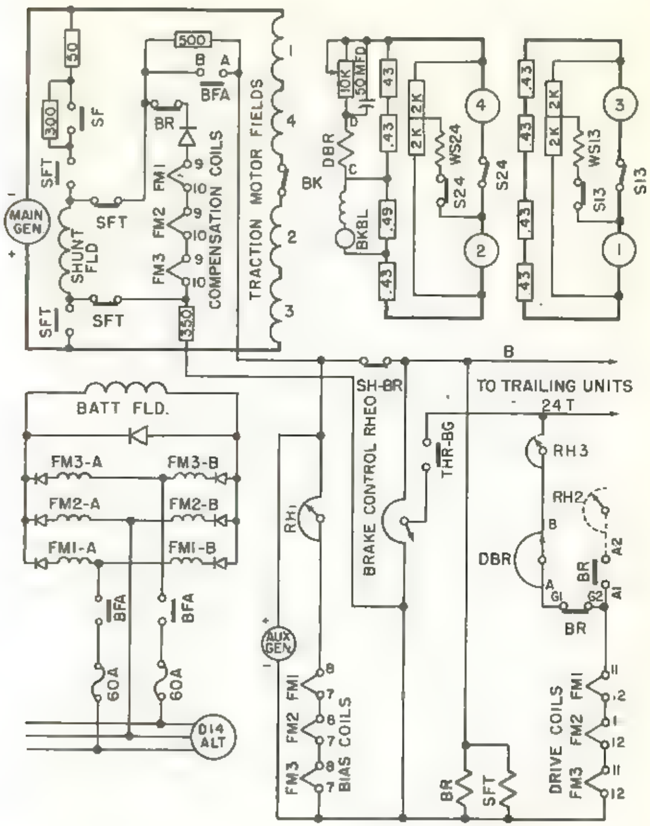


Fig. 3-1 - Selector Handle in B Position

Figure 3-2 shows the throttle handle moved from the idle position to a position corresponding to Run 1 in power. The BG wire is energized and BFA and SF have picked up. SF picking up has no function, since SFT is picked up.

BFA, however, picking up connected the magnetic amplifier load windings to the D14 alternator. This results in the 1.5 ampere minimum battery field current mentioned in conjunction with Figure 1-6 in the excitation section of this handbook, since the bias coils are still excited with the 155 milliamperes.

The 1.5 amperes in the battery field are counteracted by increasing the strength of the bucking current in the shunt. BFA interlock A-B has closed, shorting out the 500 ohm resistor and thus allowing sufficient bucking current in the shunt field to hold the armature current to a maximum of 50 amperes at top speed.

The 24T wire is still at zero potential and the magnetic amplifier drive coils are not energized at this point.

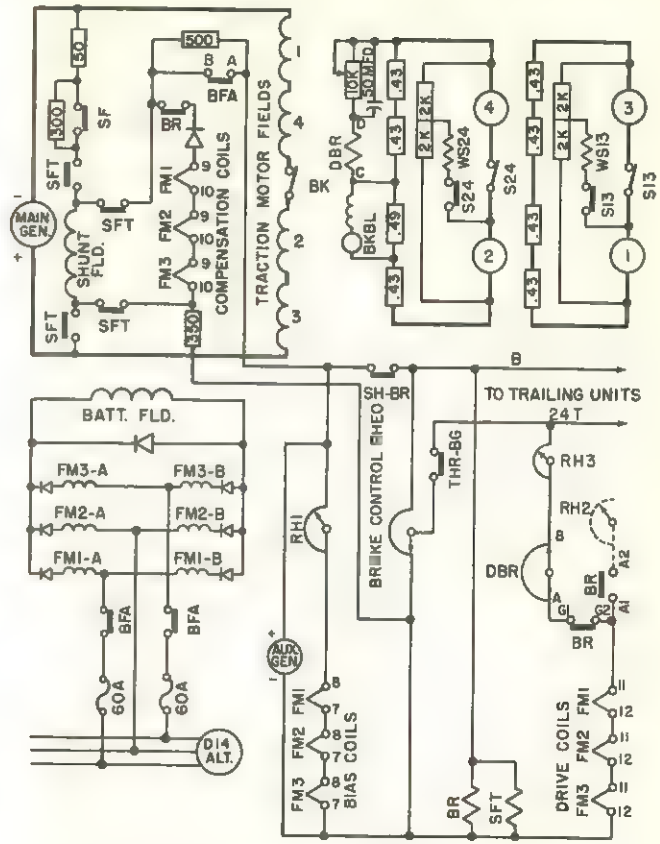


Fig. 3-2 - In Minimum Brake BG Position

In Figure 3-3 the operator has advanced the brake handle (throttle) sufficiently to cause a 10 volt potential on the 24-T trainline wire.

The 10 volts result in approximately 6 milliamperes in the magnetic amplifier drive coils. This raises the battery field current to approximately 3.5 amperes and the traction motor field current to near 140 amperes.

Since this results in less than the 490 volts across the number 4 grid, DBR does not pick up. It is set to pick up at 635 to 640 volts.

DBR fingers A-B remain closed. A reaction has taken place in the shunt field circuit which will be dealt with later.

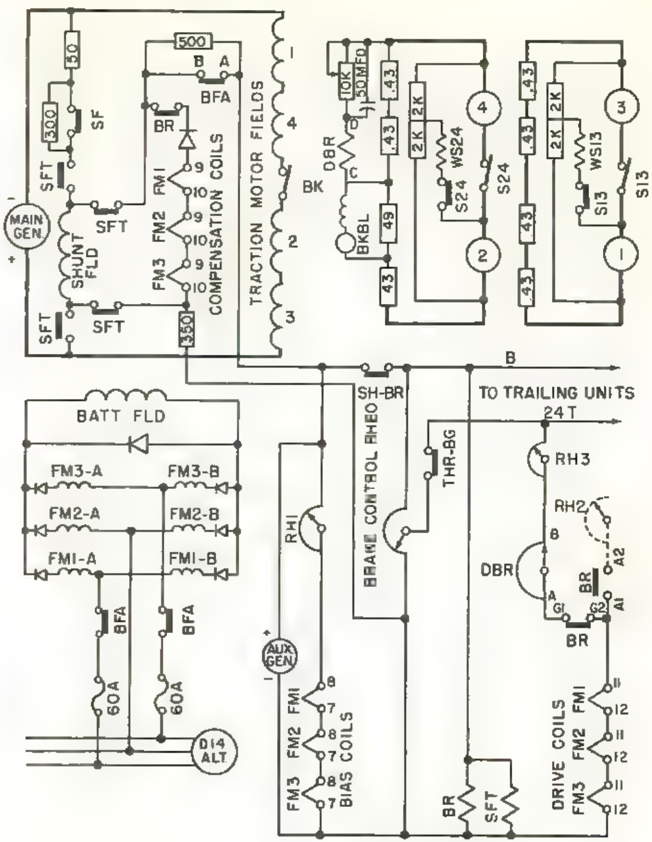


Fig. 3-3 - Partial Brake — 30 MPH

After making sure that all train slack is bunched, the operator (conditions shown in Figure 3-4) has moved the control handle slowly to the maximum brake position.

This results in the full 74 volts of the auxiliary generator being applied to the 11-12 reactor drive circuit. The battery field current increases proportionally until the motor field excitation reaches a level that results in 700 amperes armature current.

700 amperes results in a voltage across #4 grid of 640 volts, and DBR picks up. Resistance across DBR A-B is sufficient to limit the reactor drive current, which limits the battery field current and in turn limits the motor field current to a level that will result in no more than 700 amperes armature current.

DBR A-B has sufficient resistance to limit the armature current to 700 amperes even at 71 MPH.

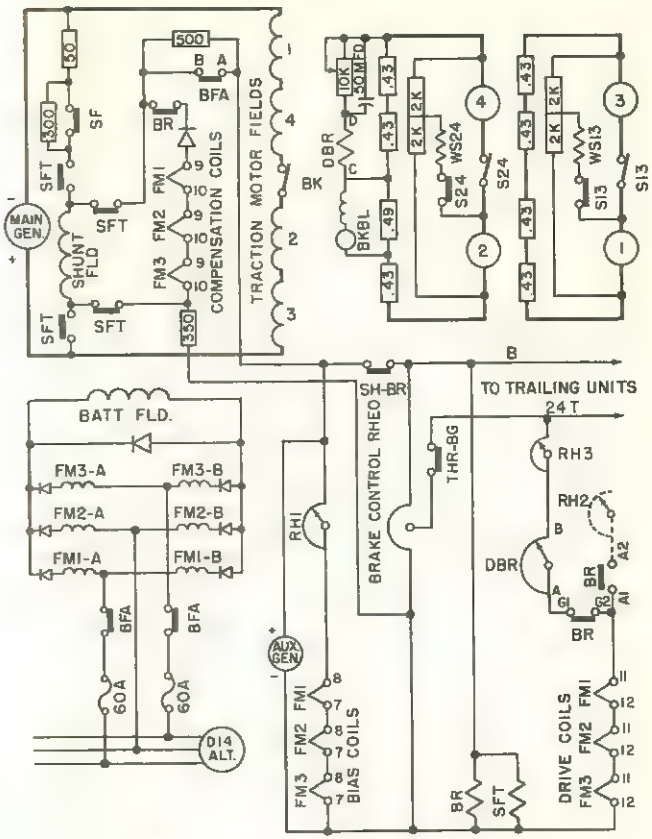


Fig. 3-4 - Full Brake — 30 MPH

Figure 3-5 depicts the conditions resulting from loss of adhesion on No. 1 axle. Loss of rotational speed of #1 armature results in a loss of voltage generated. This results in an unbalance in the bridge made up of the two armatures 1 and 3 and the two 2000 ohm resistors.

This causes relay WS13 to pick up, which drops both SF and BFA. SF opening has no function, but BFA opening removes all energy from the generator battery field and the armature current decreases at a rather slow rate controlled by the rectifier around the battery field.

As the armature voltage falls below 640 volts, DBR A-B resistance goes to zero.

The armature current continues to drop until adhesion with the rail is regained. Sand is laid on the rail automatically to improve adhesion.

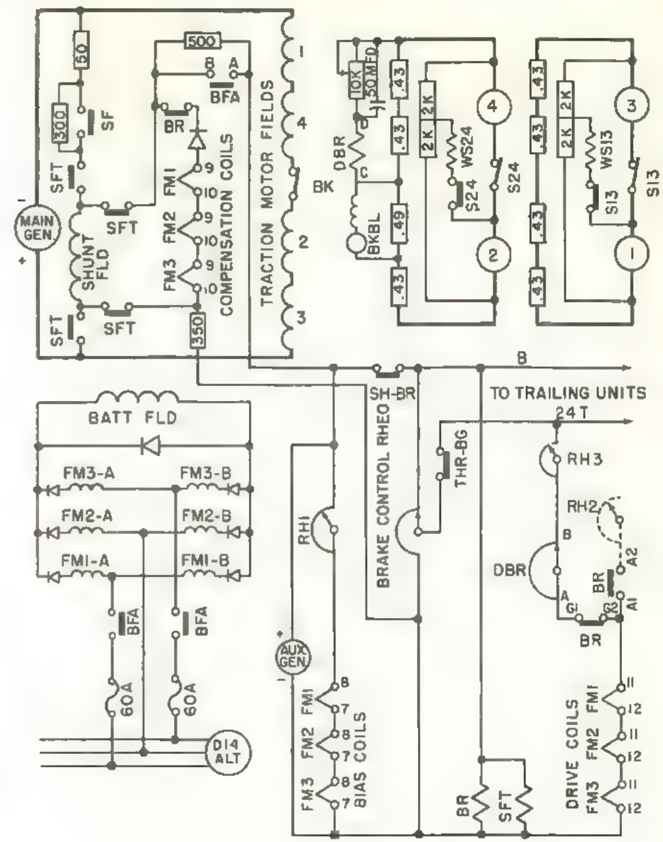


Fig. 3-5 - Wheel Slide — 30 MPH

In Figure 3-6 adhesion between the wheel and the rail has been regained and WS13 has dropped out.

SF and BFA have picked up. BFA main contacts closing impresses full D14 alternator voltage on the magnetic amplifier and the battery field. Since DBR A-B resistance is now zero, a good portion of the D14 voltage is impressed upon the battery field.

As current begins to flow in the battery field, a back voltage is built up in not only the battery field, but by transformer action in the shunt field as well. The polarity of this induced voltage is indicated on Figure 3-6 by arrowheads placed on the circuit involved.

This voltage induced in the shunt field causes a current to flow in a third reactor winding 10-9, and this current opposes the current in the 11-12 drive coils and increases the impedance of the reactors. This, of course, limits the flow of current in the battery field.

This compensating effect is weaker than the drive signal, so the net result is a slow build up of current in the battery field.

Thus the build up of current in the battery field, therefore in the motor fields and the motor armatures, is slowed by the reactor compensating winding.

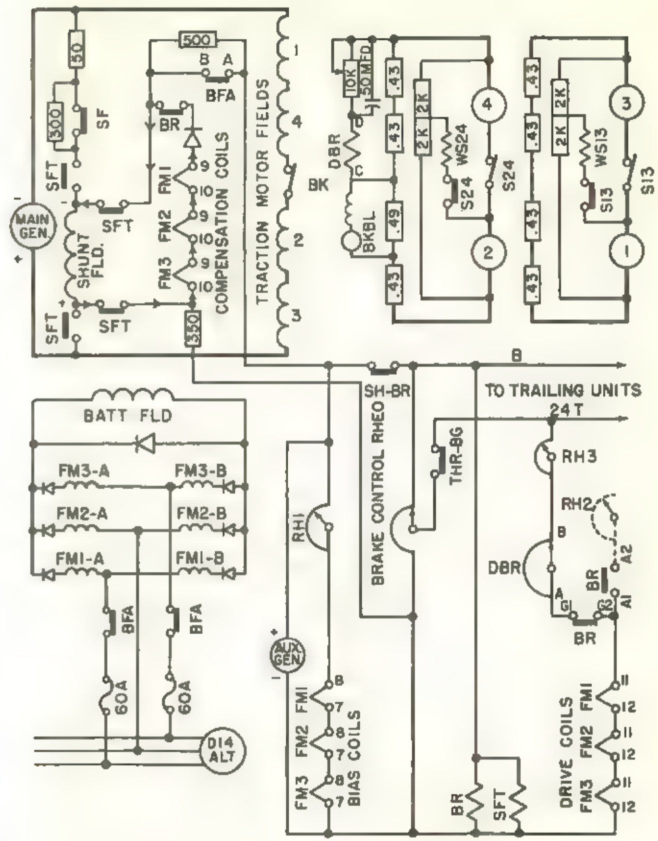


Fig. 3-6 - Adhesion Regained

In Figure 3-7 the motor armature current is still rising and has reached a level of approximately 600 amperes. Naturally, as the current rises, the voltage drop across number 4 grid also rises.

This rising voltage charges the 50 microfarad capacitor in parallel with the DBR resistor. This charging current together with the resistor current results in a prematurely high DBR coil current. This causes DBR to pick up, inserting resistance in the reactor 11-12 drive coils, thus limiting the battery field current.

As the capacitor becomes charged, however, its current no longer appears in the DBR coil. Thus, all the DBR coil current must be supplied through the resistor. Thus, the operating point of DBR rises slowly from 600 to 700 amperes as the 50 microfarad capacitor becomes charged. This anticipation effect together with the compensation effect results in very stable DBR function with very little overshoot.

These features are effective during accidental mishandling by the locomotive operator as well as during wheel slide recovery.

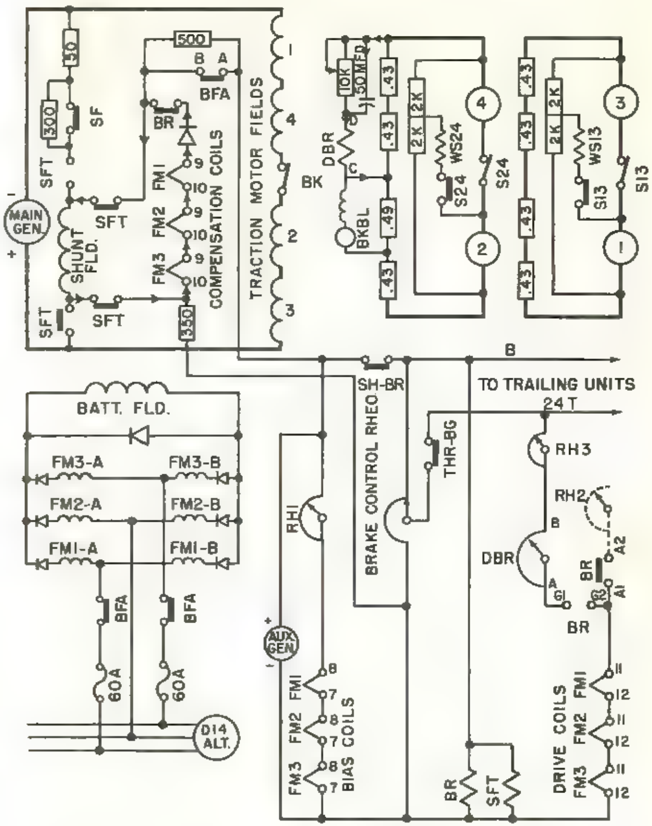


Fig. 3-7 - DBR Action After Wheel Slide

SECTION 4

TROUBLE SHOOTING

Figure 4-1 shows one method of checking the excitation reactors for shorted turns. Since reactors are basically transformers, an alternating current in any one winding will be reflected in all remaining windings unless they are open or shorted.

A handy AC source is found at the coil of the NVR relay, provided the engine is running. With the engine idling, a 100-150 watt 110 volt test light can be connected in series with, for example, the 1-2 reactor winding as shown. An AC voltmeter can then be used to check the induced voltages in the remaining windings.

If the voltage across 1-2 is 20 volts, then 7 to 8 should be 50 volts, 9 to 10 should be 125 volts, etc. These values will vary somewhat due to the load imposed by the meter used, but absolute values are not necessary.

The reactors should be disconnected as shown on Figure 4-2 and the BFA contactor kept open during the checks.

A shorted turn will result in zero or near zero voltage from 1-2, hence all other windings will show a similar lack of voltage.

The resistance to ground can be checked with a megger in the conventional manner.

Open windings can be checked with any good ohmmeter.

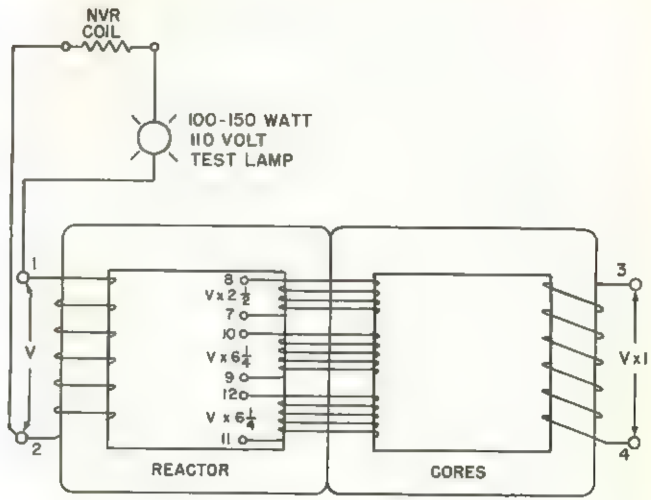


Fig. 4-1 - Reactor Check Circuit

Figure 4-2 shows suggested methods of checking excitation and feedback rectifiers.

The engine need not be running for the rectifier check. The reactor load windings should be disconnected as shown in order to prevent parallel resistance paths.

With BFA open, an ohmmeter should show a high reading when the black lead is on the positive side of the rectifier, and a low reading when it is on the negative side. A low reading on the ohmmeter when the black lead is on either side of the rectifier indicates a shorted or bad order rectifier.

With the engine at idle, the feedback reactors can be checked for shorted turns by reading the AC voltage drop across the various windings as shown. In the case of the voltage transductor GVT, a shorted turn in any one winding will result in zero or near zero voltages at all windings on that reactor.

In the case of the MGT, the windings can be checked by connecting one coil, 1-2 for instance, across the alternator and comparing the voltages of the two coils on one reactor. A shorted turn in either 1 to 2 or 3 to 4 windings will result in zero or near zero readings on both windings.

As with the excitation reactors, the insulation of the various windings to ground can be checked with a megger. The windings can be checked for opens with an ohmmeter.

T1 and T2 are conventional 1 to 4 ratio transformers and can be checked in a manner identical to that used for the reactors.

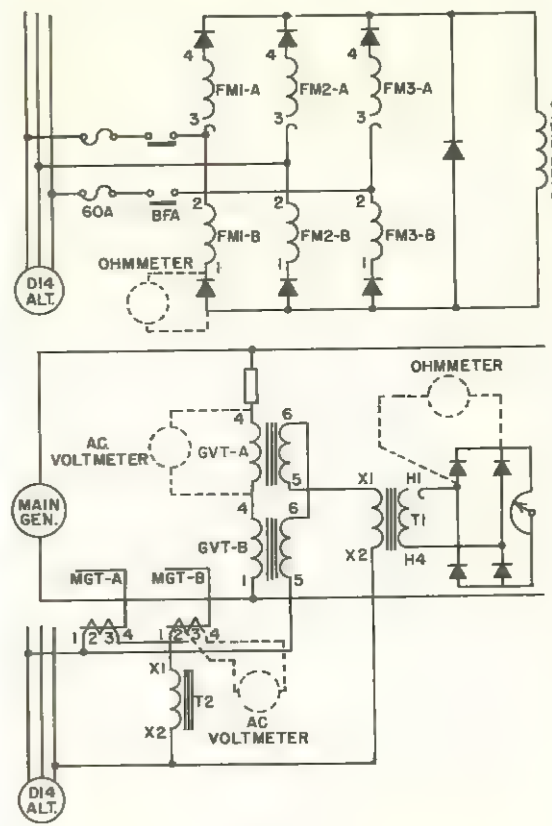


Fig. 4-2 - Rectifier-Reactor Checking

Figure 4-3 graphically illustrates the PLR relay operation. Since the main generator does not operate above 1000 volts, the operation lines are cut off at that level.

The two lines which are anchored at 2900 amperes indicate the high and low tolerances between which the PLR relay should operate when the locomotive travels at 18.5 MPH (62-15 gear ratio) or less.

The lines anchored at 3400 amperes indicate tolerances between which the PLR should operate at speeds between 18.5 and 30 MPH. The speeds given are approximate and will vary with motor temperature. In parallel motor connection (above 30 MPH) PLR is used only as an aid in snubbing transient overloads such as those due to motor field shunting.

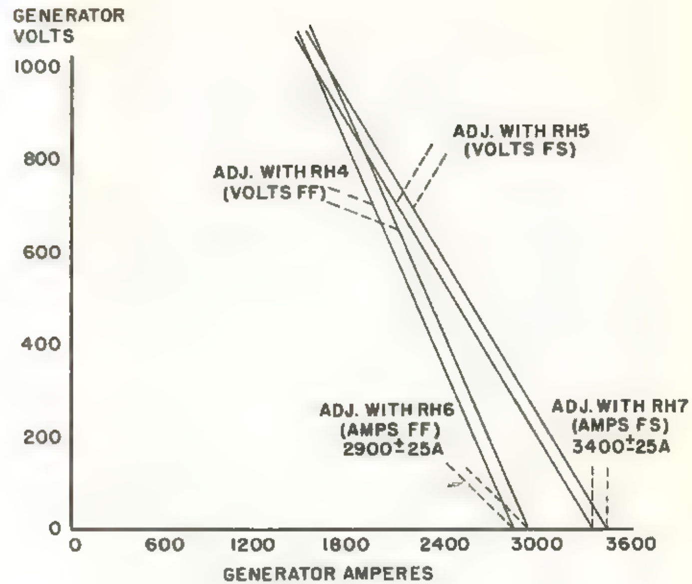


Fig. 4-3 - Power Limit Adjustment Graph

The operation of the PLR can be checked against the graph on the locomotive wiring diagram merely by short circuiting the main generator and using an MG set to excite the 1-4 coils of the GVT. Brackets adjacent to the shunt panel are provided in order to use the load shunt when short circuiting the generator.

Jacks are provided which disconnect the GVT coils from the main generator and connect them to the MG set.

The following sequence must be used in checking the PLR operation:

1. With FSA picked up and with the main generator short circuited, adjust RH6 to limit the current to 3400 amperes. The start switch on the controller should be in the "fast start" position and the engine in Run 8 to insure maximum cooling for the generator. Since 3400 amperes exceeds the rating of the generator, it should not be run at this current for longer than 60 seconds.

2. With FSA, P2, and P3 dropped out, and with the generator short circuited as in 1, adjust RH6 to limit the generator current to 2900 amperes. As in 1, this current level is above generator rating and should not continue for more than 60 seconds.

3. Still with the generator short circuited as in 1 and 2, and with FSA dropped out, apply 700 volts to GVT 1-4 coils. Adjust RH4 to limit the generator current to fall within the tolerance lines on the graph on the wiring diagram.

4. With FSA picked up and with the generator short circuited as in 1, 2, and 3, apply 700 volts to GVT 1-4 coils. Adjust RH5 to limit the generator current to fall within the tolerance lines on the graph on the wiring diagram.

Every conceivable precaution against failure has been taken in the design of the components and circuitry in the GP30 transition control.

The transition relays FTR and BTR have proven very reliable in years of service. This is especially true with regard to accuracy and reliability of operation. Once adjusted properly, these relays should hold their calibration indefinitely. Then, too, the number of adjustments on the GP30 have been held to a minimum through the use of the program switch.

The program switch itself is set at the factory, and will never require adjustment in the field. Maximum reliability of the various switches used on the program switch is accomplished by paralleling their contacts, as can be seen on Figure 4-4.

Failure of the program switch motor is guarded against through the use of a feature which energizes the overriding solenoid, ORS, each time the program switch is signaled to step either up or down during normal operation; this feature has the effect of softening each shunt step. However, should the program switch fail to rotate due to mechanical or motor trouble, ORS will be energized continuously and will hold the load regulator in the minimum field position. With the load regulator in minimum field, the motors and generator are protected from overload regardless of transition position.

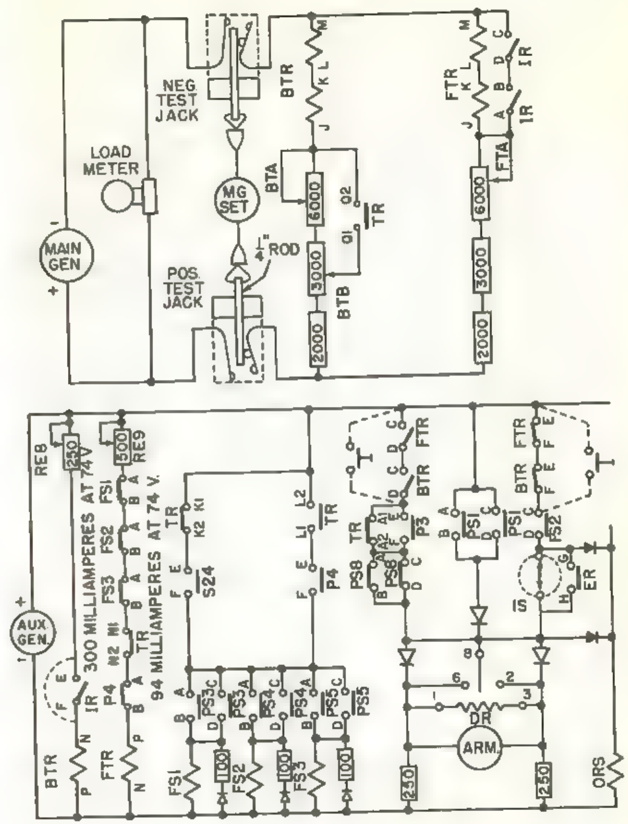


Fig. 4-4 - Trouble Shooting

Should transition trouble occur, following are some suggestions for finding the cause of the trouble:

TRANSITION CYCLING

1. Failure of the circuit to the BTR N-P coil. With the IR relay picked up, 300 milliamperes should flow in the N-P coil at 74 volts, and BTR should pick up.
2. Failure of the FTR P-N coil circuit. With FS1, FS2, FS3 and P4 contactors open and TR relay picked up, 94 milliamperes should flow in FTR P-N coil at 74 volts, with P side of coil positive.
3. Lack of motor field shunt. Check operation of the FS contactors by clipping snap switches across FTR and BTR contacts as shown on Figure 4-4. IR E-F contacts should be jumpered for this test. Closing the FTR snap switch will cause the program switch to step up, and closing the BTR switch will cause it to step down.
4. Failure of the program switch motor to rotate. This can be checked for as in 3 above.
5. Lack of dropout delay of the IR relay. This relay should drop out approximately 1 second after it has been de-energized. Loss of time indicates CA1 or RE15 bad order.
6. Failure of the transition relays FTR and BTR to function. An M.G. set can be quickly connected to the coils of these relays by inserting 1/4 inch metal rods in the test jacks provided. This disconnects the relay coils from the main generator, and the M.G. set can be connected to the coils by merely clipping to the rods. This will also check RE4 and RE5 for open tubes.
7. Transition relay settings. This should be the last thing checked since these relays lose calibration so seldom. A bracket is provided adjacent to the load meter shunt panel whereon the load shunt can be used to short circuit the generator for this test. Operation of FTR and BTR can thus be checked at various main generator currents against the graph on the locomotive wiring diagram, using the M.G. set as in 6 above.

FAILURE TO MAKE TRANSITION

1. Check circuit to the program switch, using snap switches across the FTR and BTR contacts.
2. Check function of the program switch, using snap switches as in 1.
3. Check function of the FS contactors, TR relay, and power contactors using snap switches as in 1 and 2 above.
4. Check function of FTR and BTR relays using M.G. set, as in 6 under transition cycling.
5. Check function of SF and BFA contactors and the ability of the main generator to make volts. Check battery field fuses. The GP30 is equipped with two 60 ampere fuses.
6. Check shunt field 50 ohm series resistor for open tube or strap.

Figure 4-5 shows the various adjustments required for the GP30 dynamic brake control. Once properly set, these adjustments should not be changed. When trouble is encountered, circuitry should be checked before an attempt is made to change the adjustments.

When DBR operation is checked, several seconds should be allowed for the 50 microfarad capacitor to become fully charged. The pickup point of DBR can be checked by connecting an M.G. set across the resistor and coil after first disconnecting them from the grids. The operation of the armature of DBR will be indicated by an increase in resistance from A to B, which can be checked with an ohmmeter. The M.G. set voltage should be increased very slowly to allow for dashpot action in the DBR operator.

The magnetic amplifier drive coil current can be checked by putting the locomotive in the dynamic brake position at standstill. The voltage at the 24T trainline wire should increase from zero to 74 volts as the brake control handle is moved to the maximum brake position. The 11-12 drive coil current should increase from zero to 42 milliamperes.

The reactor bias current should be 155 milliamperes at 74 volts.

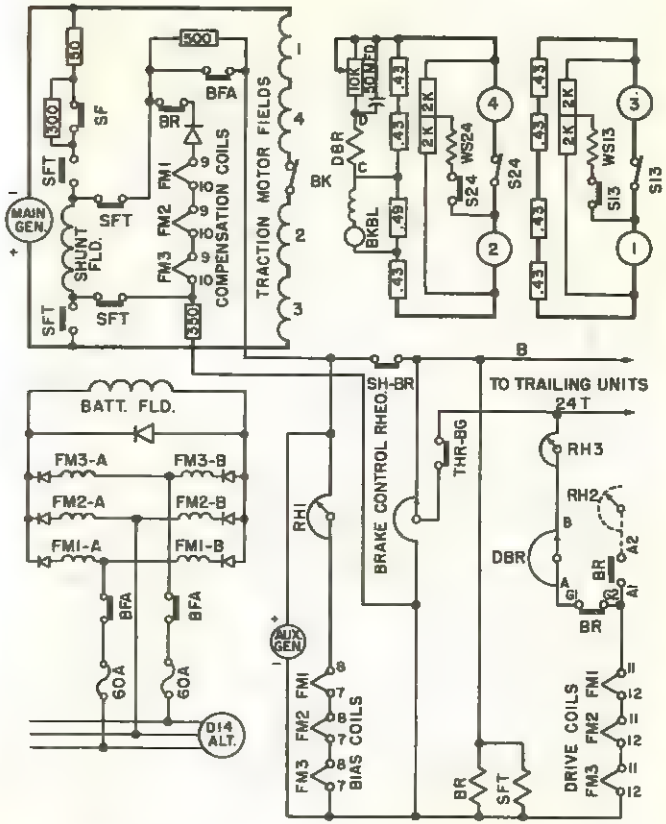


Fig. 4-5 - Adjustments and Trouble Shooting

The following are a few aids in trouble shooting the dynamic brake control:

LACK OF MOTOR FIELD CURRENT

1. Check voltage at the 24T wire. Loss of voltage indicates a tripped control breaker or faulty brake control rheostat.
2. Check reactor 11-12 drive coil current.
3. Failure of the BK contactor to close. Check circuit to this contactor.
4. BFA fuses missing or blown. If blown, check condition of reactors and rectifiers as suggested in the text adjacent to Figs. 4-1 and 4-2.

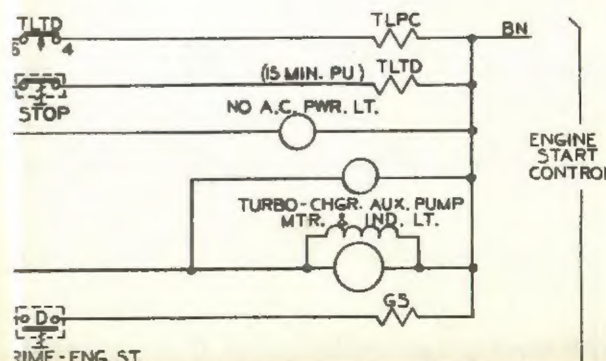
EXCESSIVE MOTOR FIELD CURRENT

1. Check reactor bias coil current.
2. Check for shorted CR8 rectifier in the compensation coil circuit.

BRAKE WARNING RELAY ACTION

1. Check for loss of reactor bias coil current.
2. Check for excessive reactor drive coil current.
3. Check pickup of DBR as prescribed above.
4. Check for shorted CR8 rectifier in the compensation coil circuit.
5. Check pickup of BWR with an M.G. set. Allow at least 5 minutes at 1000 volts to heat the relay coil and resistor. Check against the values indicated on the locomotive wiring diagram.

GP 30 CONTROL WIRING DIAGRAMS



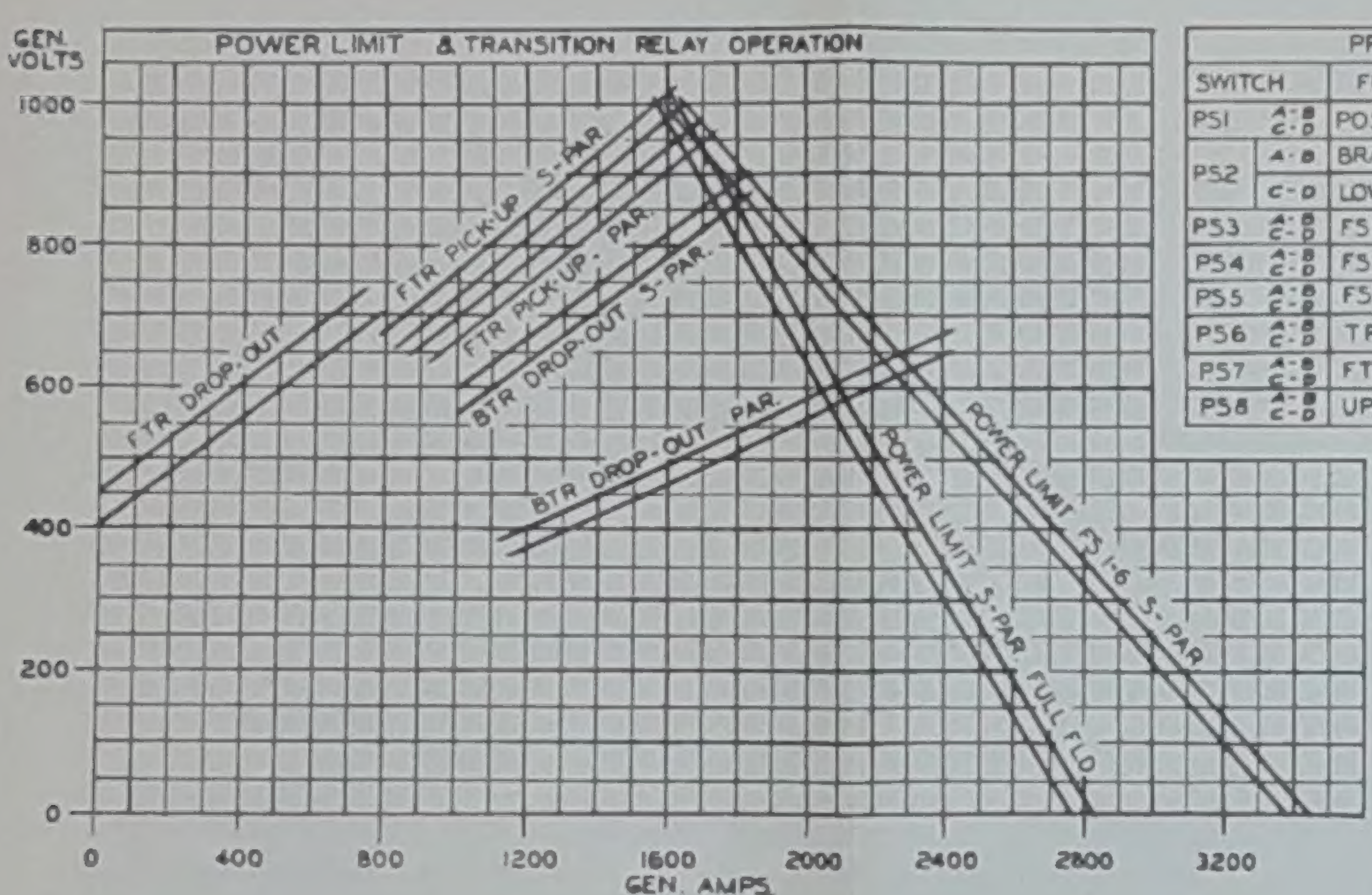
GP 30 CONTROL WIRING DIAGRAMS

ENGINE START - STOP - RUN & SPEED (2250 H.P.) SEQUENCE CHART																		
CONDITION	I.S. SW.	CONTROLLER			START & RUN RELAYS									GOVERNOR SOL.				ENG. R.P.M.
		RH.	SH.	TH.	TLTD	TLPC	GS	ORS	FPC	FP	NVR	PCR	ER	AV	BV	CV	DV	
START	ST.	OFF	OFF	IDLE	●	●	●	●	●	●		●						0
IDLE	RUN	FOR/REV	RUN	IDLE				●	●	●	●	●	●					275
RUN				1					●	●	●	●	●					275
				2					●	●	●	●	●	●				355
				3					●	●	●	●	●			●		435
				4					●	●	●	●	●	●		●		515
				5					●	●	●	●	●		●	●	●	595
				6					●	●	●	●	●	●	●	●	●	675
				7					●	●	●	●	●		●	●		755
				8					●	●	●	●	●	●	●	●		835
STOP				STOP	●	●		●	●	●		●					●	0

27 PT RECEPTACLE WIRING			
PT. #	TAG	PT. #	TAG
1	IT	15	AV
2	SG	16	ER
3	DV	17	B
4	N	18	P
5	SAR/SAF	19	M
6	GF	20	BW
7	CV	21	BG
8	RE/FO	22	CC
9	FO/RE	23	SA
10	WS	24	24T
11	SAF/SAR	25	XF/XB
12	BV	26	SV
13	PC	27	RV
14	14T		

TRACTION MOTOR CONNECTIONS SEQUENCE CHART																
CONDITION	FOR REV	RVF RVR	BKP	S	P	FS1	FS2	FS3	SF	BFA	TR	GFR	BKB	BK	BR	SFT
SERIES-PARALLEL	●	●	●	●					●	●		●				
SERIES-PARALLEL-SHUNT	●	●	●	●		●	●	●	●	●		●				
PARALLEL	●	●	●		●				●	●	●	●				
PARALLEL-SHUNT	●	●	●		●		●	●	●	●	●	●				
DYNAMIC BRAKE	●	●		●					●	●			●	●	●	●

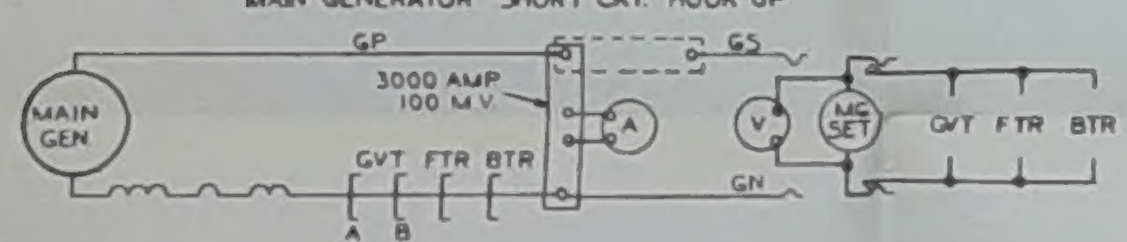
595 R.P.M.



PROGRAM SWITCH SEQUENCE CHART												
SWITCH		FUNCTION	1	2	3	4	5	6	7	8	9	10
PS1	A-B C-D	POSITIONER	■	■	■	■	■	■	■	■	■	■
PS2	A-B	BRAKE INTLK.	■									
	C-D	LOWER LIMIT		■	■	■	■	■	■	■	■	■
PS3	A-B C-D	FS1		■		■		■				
PS4	A-B C-D	FS2			■	■			■		■	
PS5	A-B C-D	FS3					■	■	■			■
PS6	A-B C-D	TR								■	■	■
PS7	A-B C-D	FTR K.O.	■	■	■	■	■	■				
PS8	A-B C-D	UPPER LIMIT	■	■	■	■	■	■	■	■	■	

■ INDICATES CONTACT CLOSED

MAIN GENERATOR SHORT CKT. HOOK-UP



1. REMOVE GENERATOR SHUNT PANEL.
2. APPLY 3000 AMP 100 MV. SHUNT DIRECTLY TO GP SHUNT PANEL STUDS & GN ADAPTER BRACKET.
3. APPLY MG SET WITH 1/4 INCH PLUGS TO TEST JACKS.
4. CHECK TRANSITION RELAYS & POWER LIMIT PER LOCOMOTIVE WIRING DIAGRAM.
5. TESTING TIME MUST BE KEPT TO A MINIMUM OVER THE D22 GENERATOR 2400 AMPS. CONTINUOUS RATING.

LOAD TEST

1. EXTERNAL LOAD BOX REQUIRED TO LOAD ENGINE TO 2250 H.P. OR 1575 KW.
2. CONNECT TWO 1325/24 LEADS (OR EQUIVALENT) FROM GP & GN BUS BARS RESP. TO LOAD BOX.
3. LOAD BOX RESISTANCE OF NOT LESS THAN .28 OHMS (2400 AMPS. GRID CAPACITY) TO NOT MORE THAN .6 OHMS (1600 AMPS. GRID CAPACITY) MAY BE USED. (.5 TO .56 OHMS FOR MOTOR CUTOUT 1200KW ADJUSTMENT)

BASIC + DYNAMIC CKTS. ARE SHOWN ON THESE PLATES. REFER TO WIRING DIAGRAM FOR ADDITIONAL FUNCTIONS.

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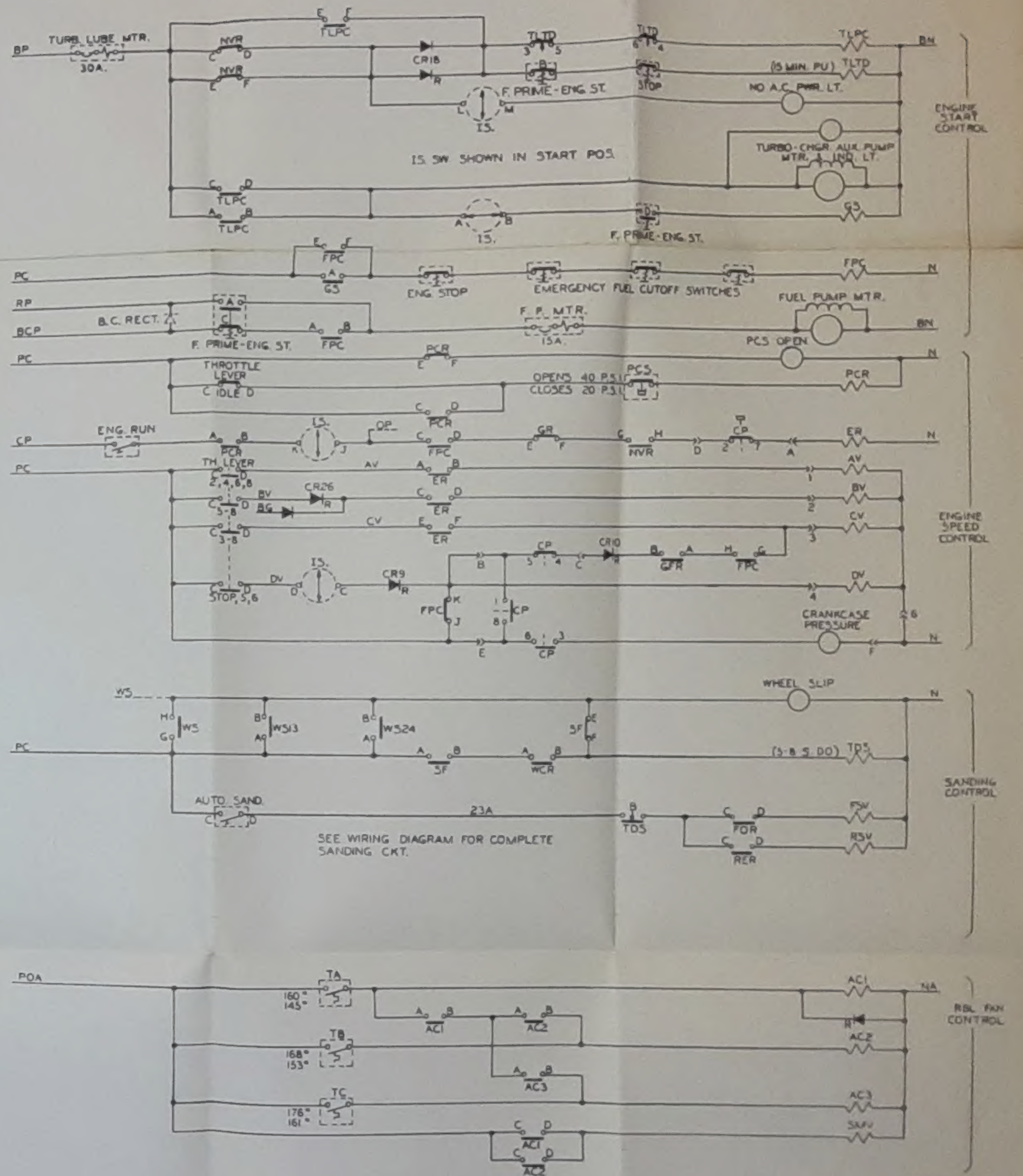

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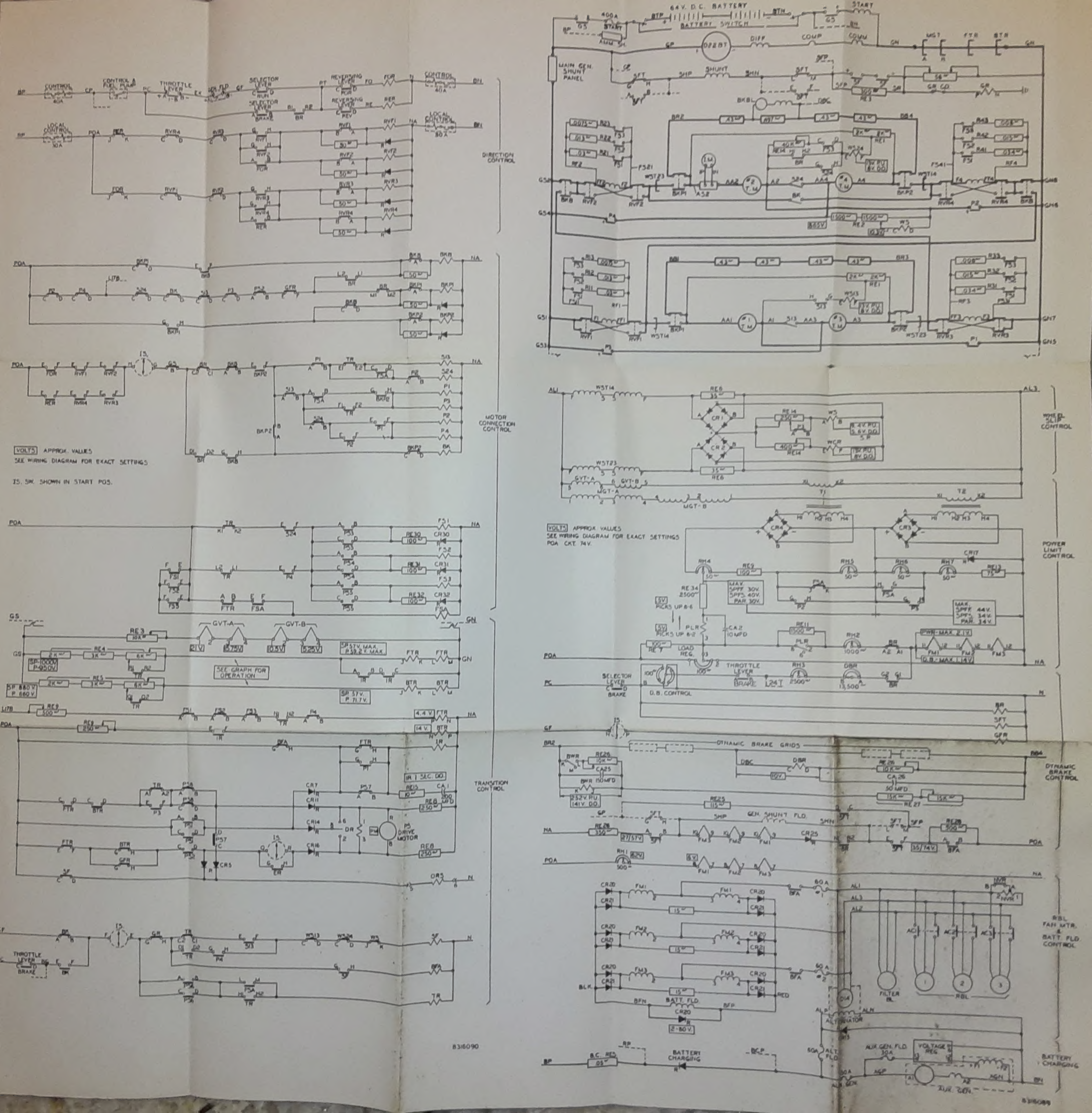
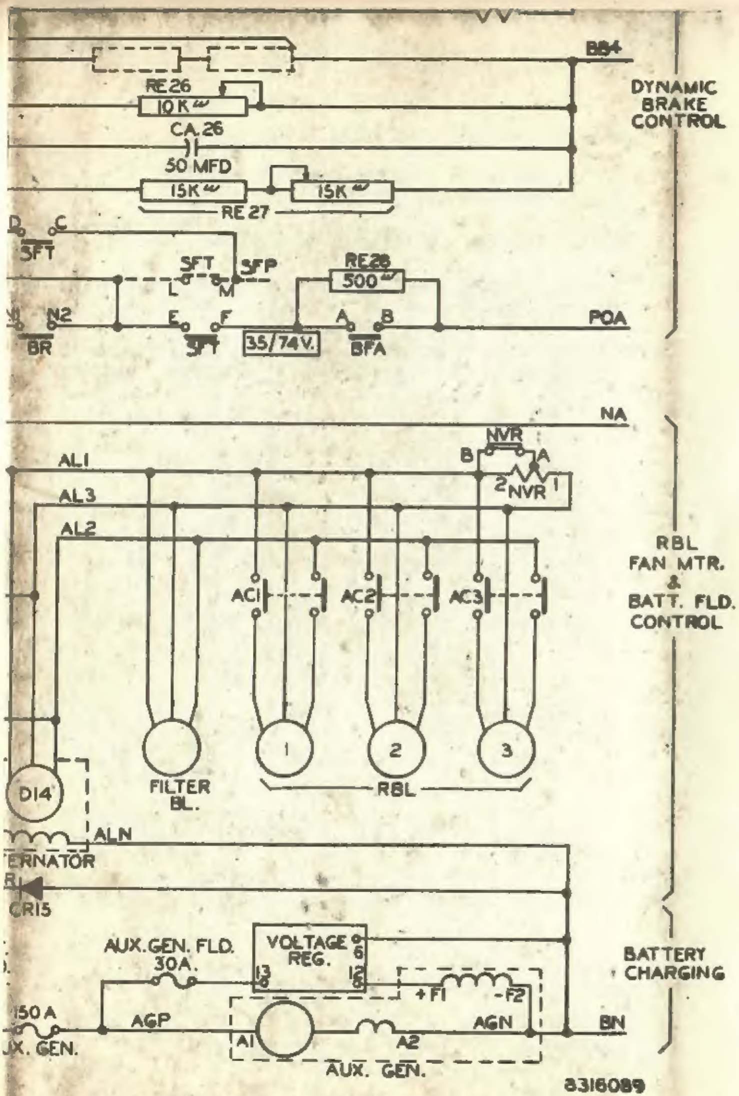

64 V. D.C. BATTERY
BATTERY SWITCH
MAIN GEN. SHUNT PANEL
DIRECTION CONTROL
MOTOR CONNECTION CONTROL
VOLTS APPROX. VALUES
SEE WIRING DIAGRAM FOR EXACT SETTINGS
IS. SW. SHOWN IN START POS.
TRANSITION CONTROL
SEE GRAPH FOR OPERATION
WHEEL SLIP CONTROL
VOLTS APPROX. VALUES
SEE WIRING DIAGRAM FOR EXACT SETTINGS
POA CKT. 74V.
POWER LIMIT CONTROL
D.B. CONTROL
DYNAMIC BRAKE GRIDS
DYNAMIC BRAKE CONTROL
GEN. SHUNT FLD.
RBL FAN MTR. & BATT. FLD CONTROL
BATT. FLD.
ALTERNATOR
BATTERY CHARGING
VOLTAGE REG.
AUX. GEN.
8316090
8316089


BB4
DYNAMIC BRAKE CONTROL
RE26
10K
CA.26
50 MFD
15K
15K
RE 27
SFT
SFT
SFP
RE28
500
N2
BR
SFT
35/74V.
BFA
POA
NA
NVR
NVR
AL1
AL3
AL2
AC1
AC2
AC3
RBL FAN MTR. & BATT. FLD. CONTROL
D14
FILTER BL.
1
2
3
RBL
ALN
CR15
AUX. GEN. FLD. 30A.
VOLTAGE REG.
BATTERY CHARGING
150 A
AGP
+F1
-F2
AGN
BN
A1
A2
AUX. GEN.
8316089